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MINING METALLURGICAL INSTITUTE OF TAJIKISTAN

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Kabul University
Ministry of Higher Education
Islamic Republic of Afghanistan

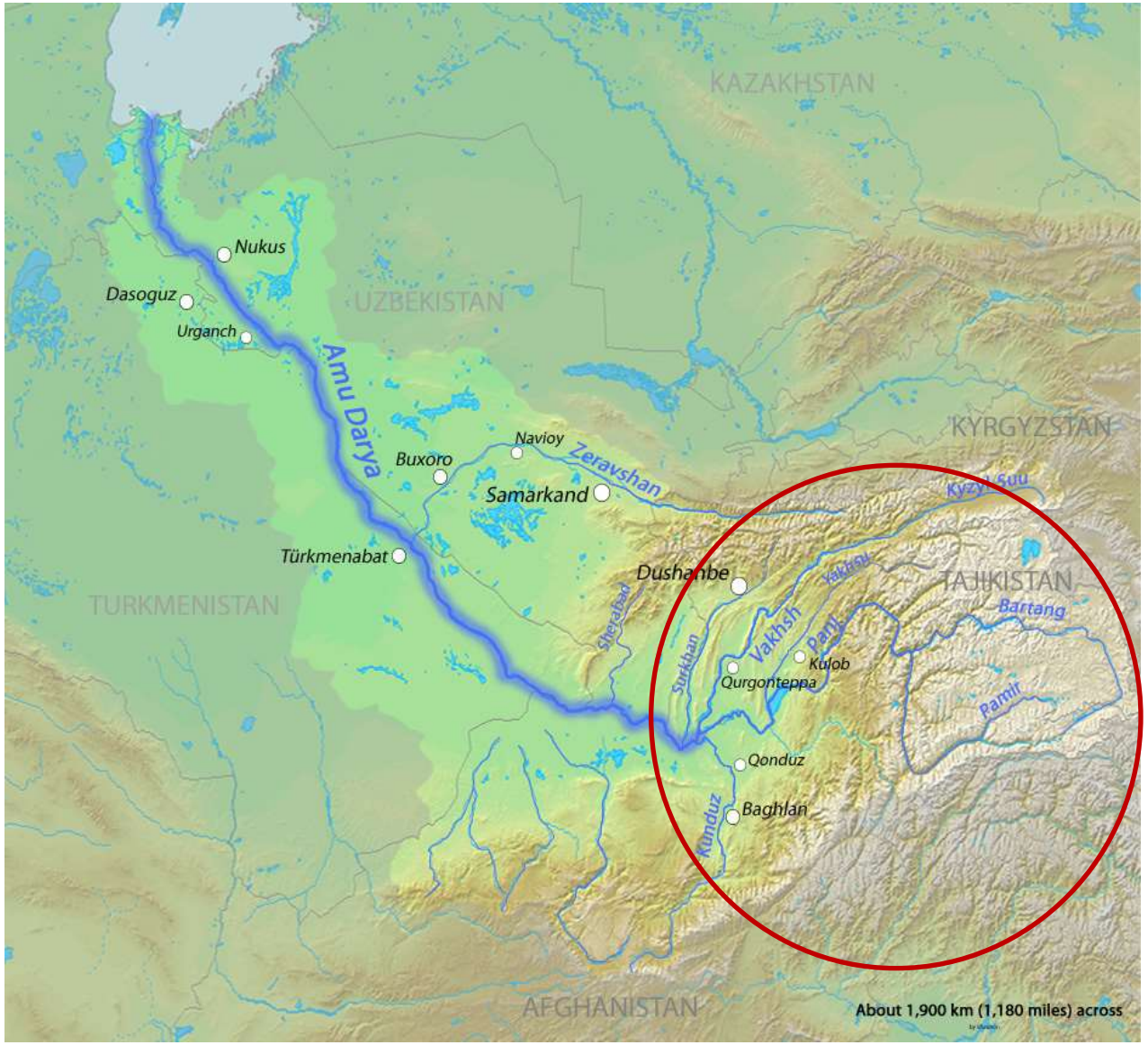
Integrated Water Resources Management (IWRM) and SEA of Kabul and Amu Darya Rivers

Dr. Zheenbek Kulenbekov

PEER NAS USAID Forum

10th -14th of December, 2018

Amu Darya river basin



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Water quality, stream flow

Upper stream of Dara river (Doorot-Korgon village)

N 39° 33.141'

E 072° 11.395'

Elevation: 2525 м

Radiation background: 0,23 mrSv

Eutech instruments	Velocity	
pH = 8.47, t = 8,4 °C	Q = 2,427 m³/S	Q = 2,668 m³/S
Ion = -82 mυ	V = 1,44 m/S	V = 1,6 m/S
Conductivity = 316,2 µS	H = 1,665 m	H = 0,664 m
TDS = 303,2 ppm	12:42	
NaCl = 281,1 ppm	Q = 1,950 m³/S	Q = 2,440 m³/S
Resistivity = 1,650 kŭ	V = 1,24 m/S	V = 1,47 m/S
O2 = 74,6% , 5,7 mg/L при t=12,4 °C	H = 1,584 m	H= 0,684 m

Dara river end,joined with Kyzyl-Suu river

N 39 33.851'

E 072 11.789'

Elevation: 2473 м

Radiation background: 0,22 mrSv

pH = 8.71, t = 13,9 °C	Q = 2,066 m³/S	Q = 2,167 m³/S
Ion = -97,9 mυ	V = 1,23 m/S	V = 1,29 m/S
Conductivity = 310,6 µS	H = 0,674 m	H = 0,705 m
TDS = 297.5 ppm		
NaCl = 285.8 ppm		
Resistivity = 1,681 kŭ		
O2 = 72% , 5,08 mg/L при t=14 °C		

Methods

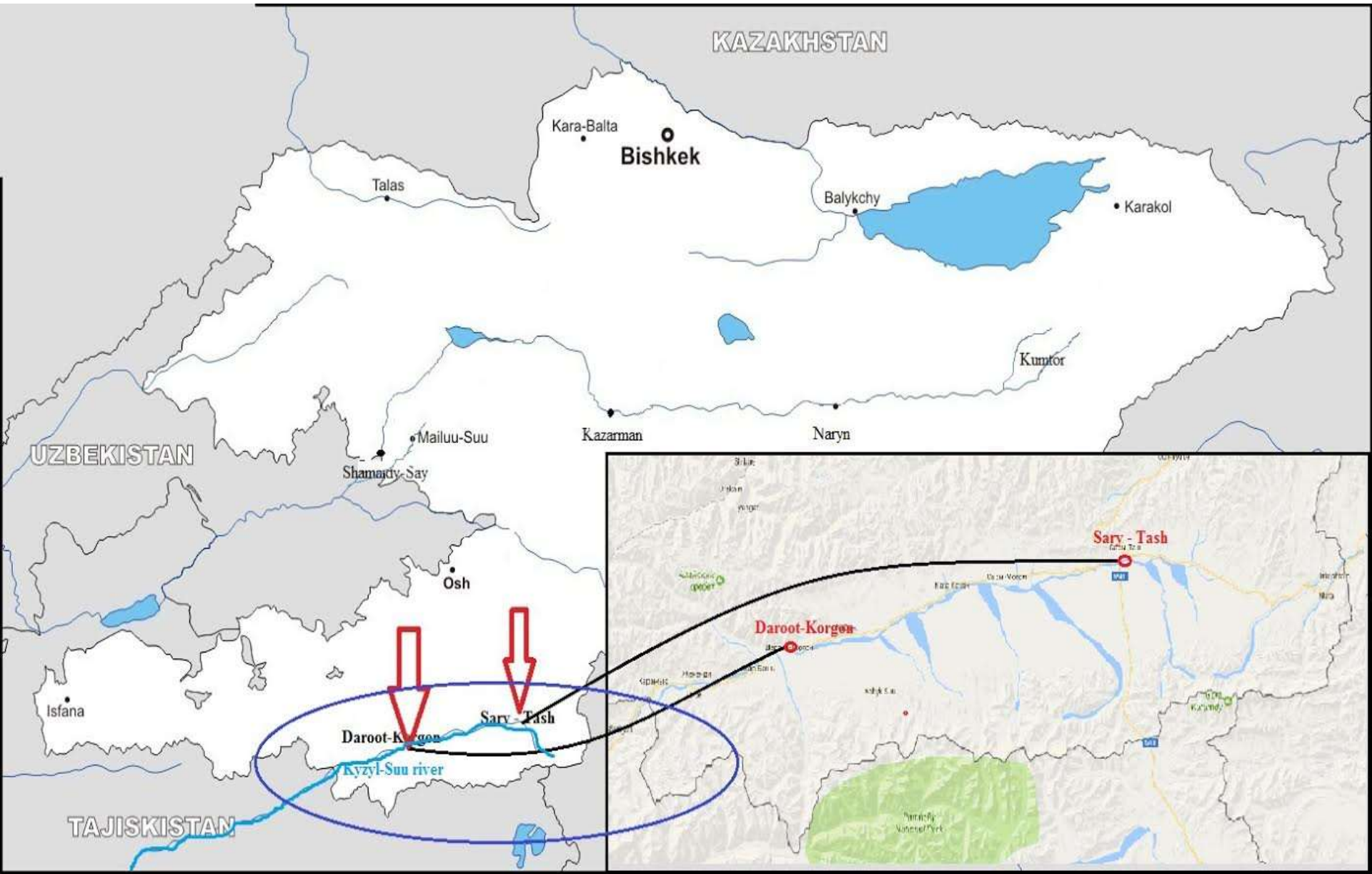
Land cover and land use classification practices by using remote sensing

- On-site, ground surveys are desirable for high-quality and valid land cover classification
- Use of cadastral maps would be beneficial for land classification as well.

Interaction between NDVI and weather variables

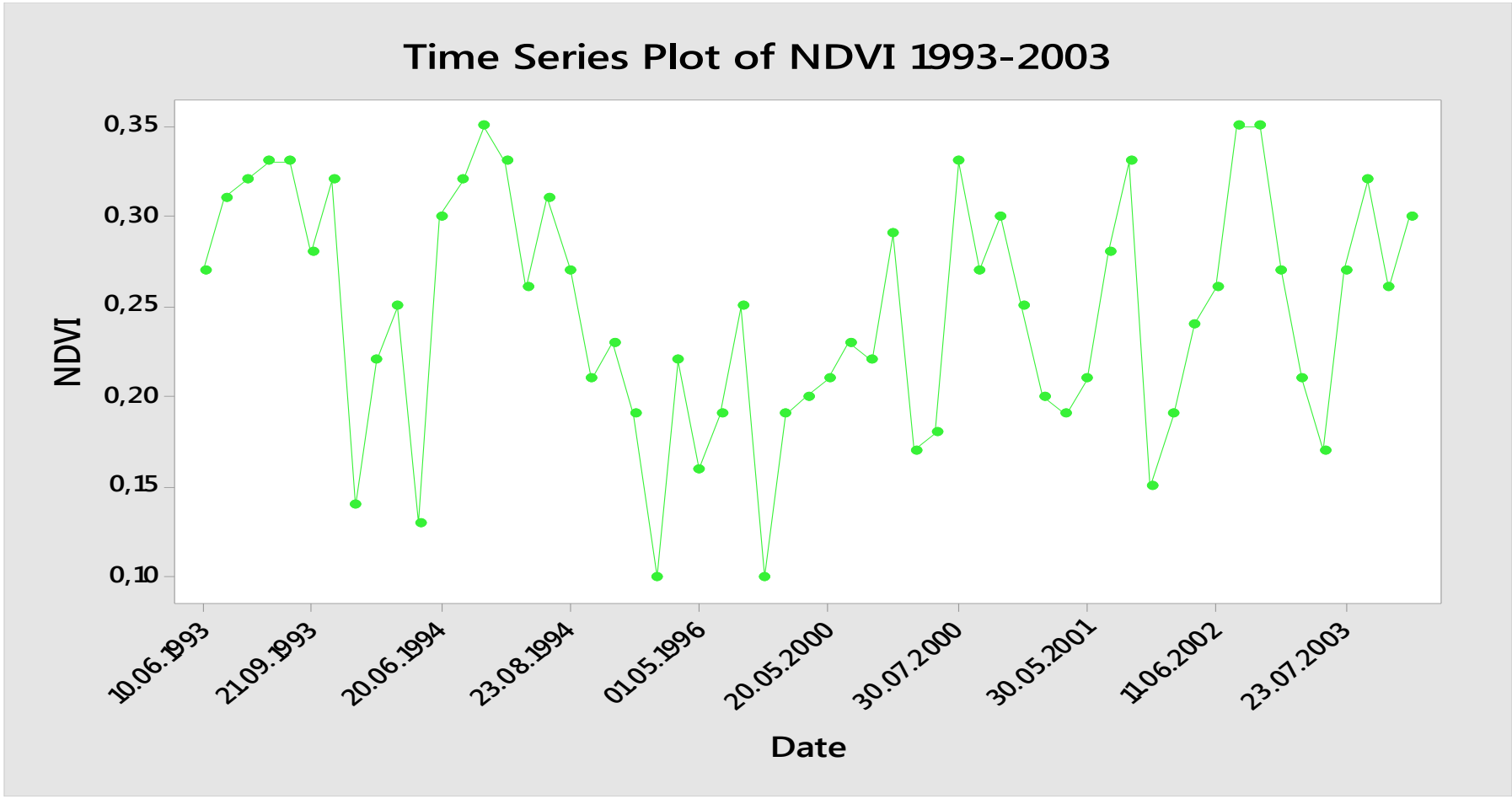
- Climate change affects precipitation, temperature and NDVI globally
- By understanding the relationship between NDVI and climatic variables it is possible to predict future climate change scenario.

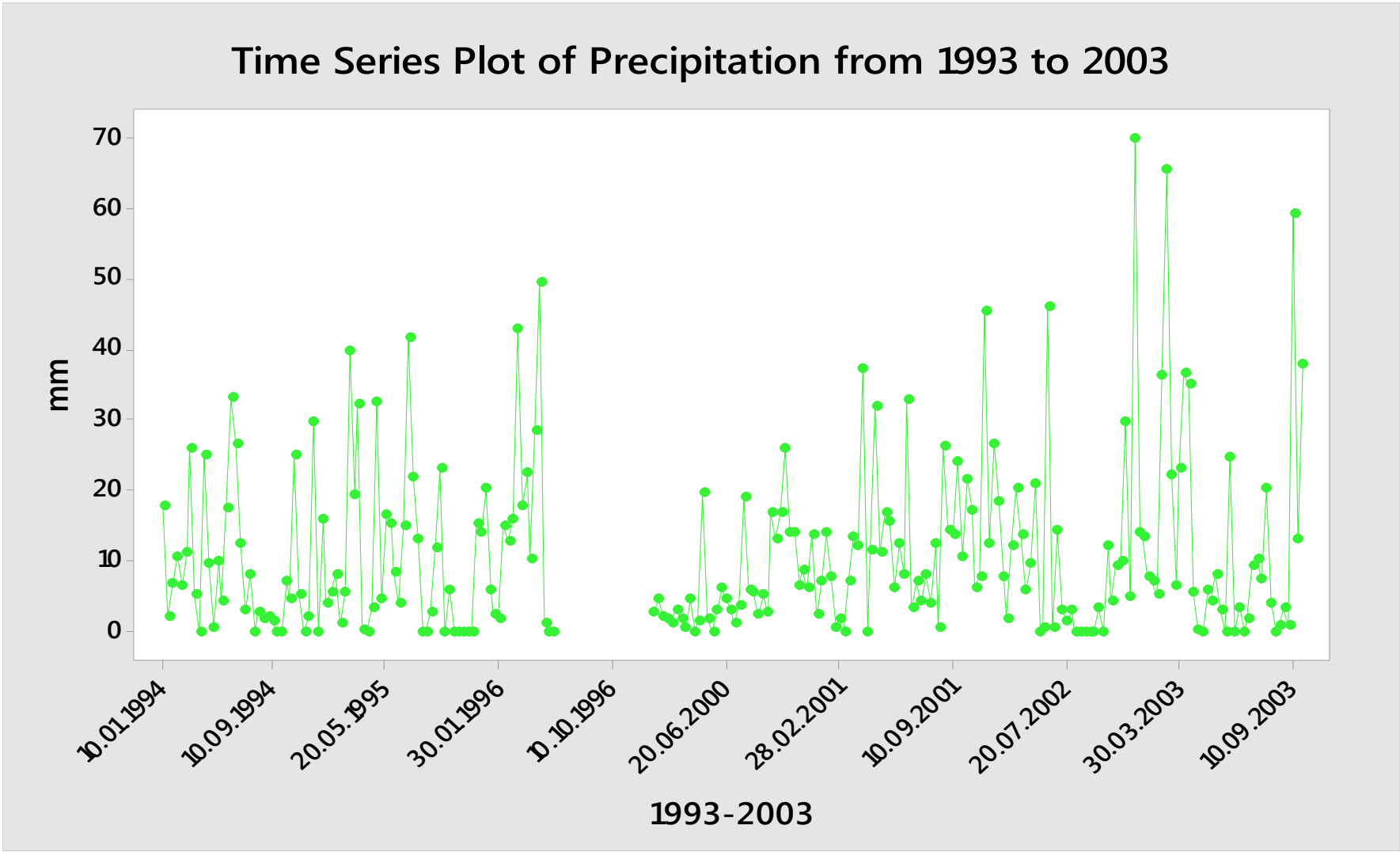
Kyzyl-Suu River Basin



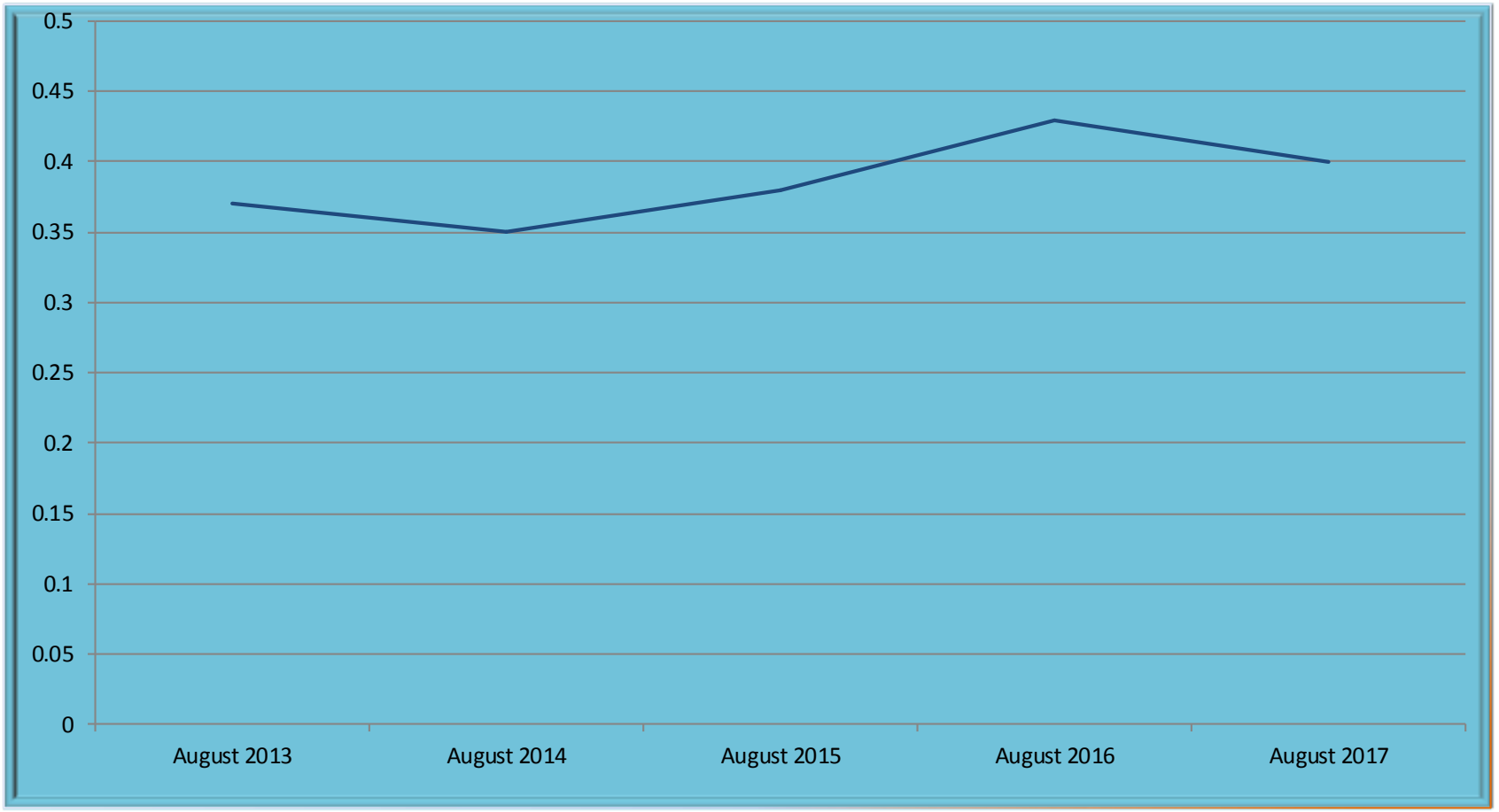
Results

- Two years (1994, 2003) have been found with significant correlation coefficient between NDVI and climatic variables
- Not enough to establish a significant annual trend between NDVI and climatic variables
- Seasonal trend was found: as a rule, the lowest NDVI values are observed in May than reaches its peak at the end of July and at the beginning of August and decreases at the middle or end of September
- Trend was found in NDVI values over the last five years in Daroot-Korgon – there is an inter-annual even distribution of values without any sharp fluctuations and variations


Time Series Plot of NDVI 1993-2003
NDVI
0,35
0,30
0,25
0,20
0,15
0,10
10.06.1993
21.09.1993
20.06.1994
23.08.1994
01.05.1996
20.05.2000
30.07.2000
30.05.2001
11.06.2002
23.07.2003
Date


Time Series Plot of Precipitation from 1993 to 2003
mm
70
60
50
40
30
20
10
0
10.01.1994
10.09.1994
20.05.1995
30.01.1996
10.10.1996
20.06.2000
28.02.2001
10.09.2001
20.07.2002
30.03.2003
10.09.2003
1993-2003

Time series of NDVI over the last five years



August 2013	August 2014	August 2015	August 2016	August 2017
0.37	0.35	0.38	0.43	0.40

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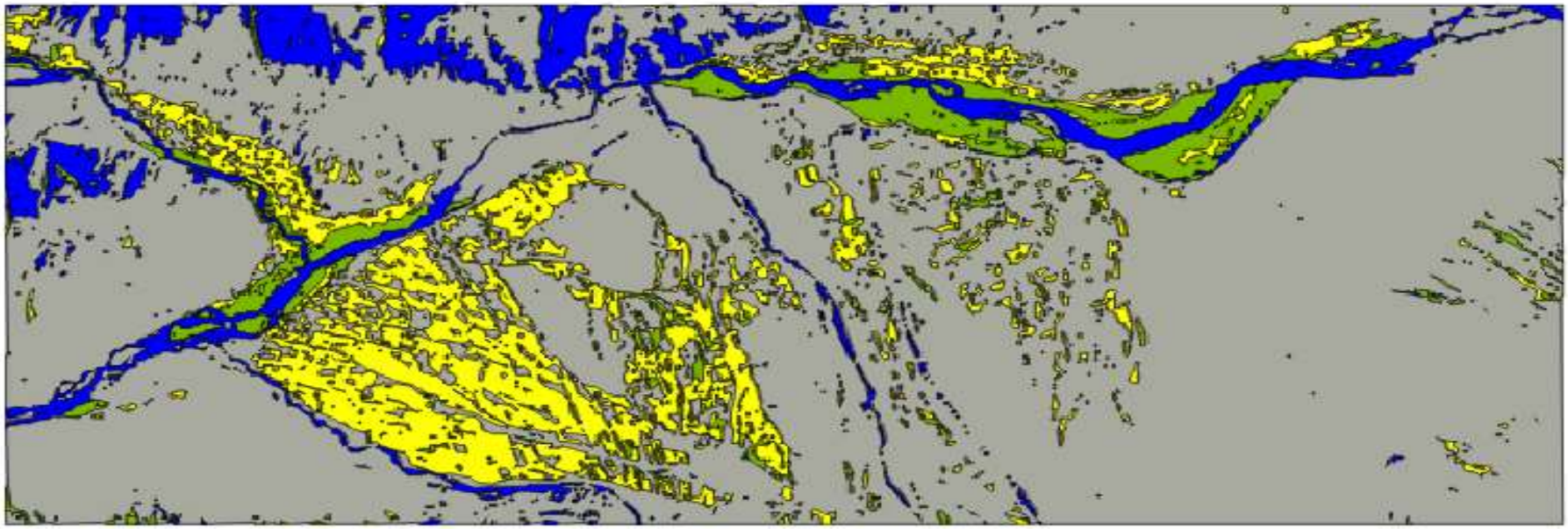
Daroot – Korgon summer NDVI value 2013

Daroot – Korgon summer NDVI value 2017

Land cover classification of Daroot - Korgon

Chong-Alay Valley map. Land cover classification of Daroot Korgon administrative center



Conclusion

- Only two years (1994 and 2003) were found with a positive correlation between NDVI and climatic variables
- Not enough to establish a significant annual trend between NDVI and climatic variables
- Seasonal trend was found: as a rule, the lowest NDVI values are observed in May than reaches its peak at the end of July and at the beginning of August and decreases at the middle or end of September
- Trend was found in NDVI values over the last five years in Daroot-Korgon – there is an inter-annual even distribution of values without any sharp fluctuations and variations.
- Due to partial lack of weather station observations as well as NDVI values, it is hard to analyze the interlink between NDVI and climatic variables

Daroot Korgon Administrative center

Population 4726 (2009)

Elevation 2469

Source: Google Maps

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Methods of Data Collection

- Map
- GPS coordinates
- Questionnaire (qualitative)
- Preliminary preparation and practical guidelines
- Focus group

Methodology

- ***Primary data:***
- Surveys and questionnaires (total:92 households; 46 Boroldoi village, 17 Oirondu, 12 Kuntuu, 17 Daroot Korgon)
- Socio-economic analysis and compare Case Studies from Kyrgyzstan (Chui Valley and Chon Alay valley)
- ***Secondary data:***
- Software excel and Minitab
- Articles and Scientific Researches as supplementary material

Key points of socio-economic analysis

- Water Accessibility
- Household conditions
- Access to electricity
- Agricultural machinery
- Crops
- Average income
- Livestock
- Infrastructure(electricity, landline, internet)

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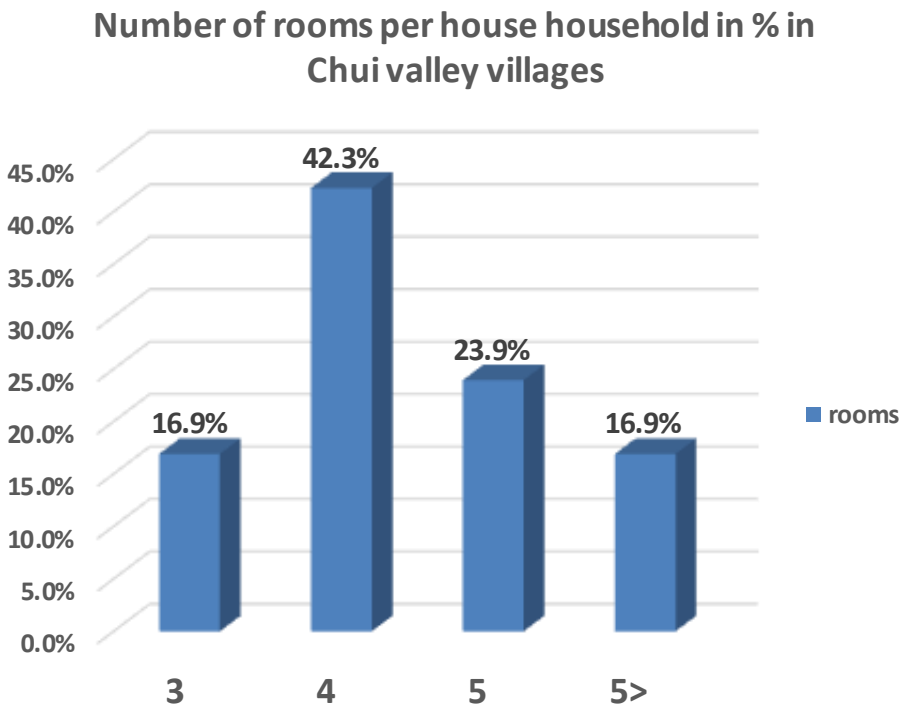
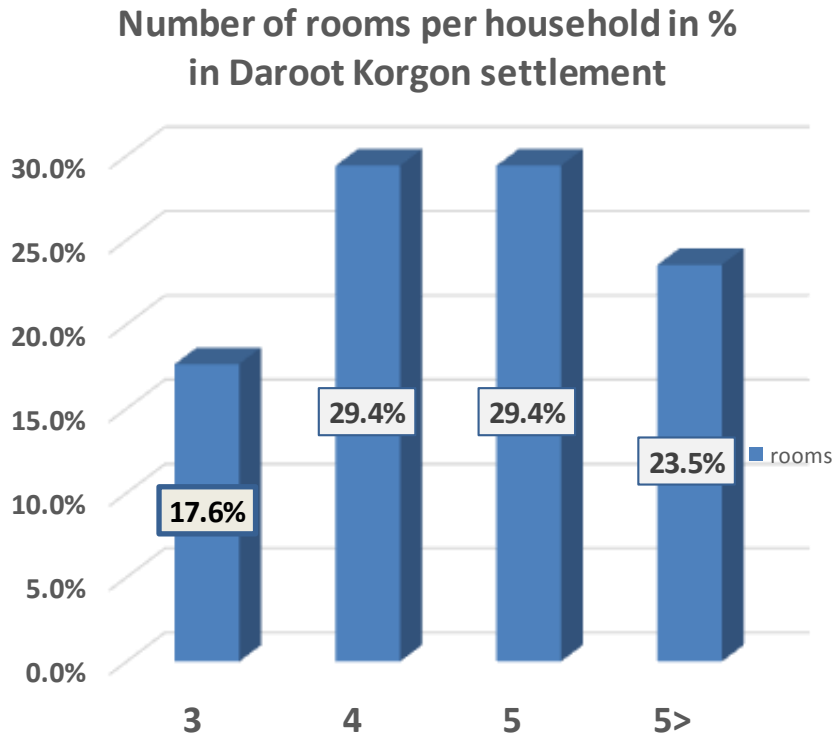
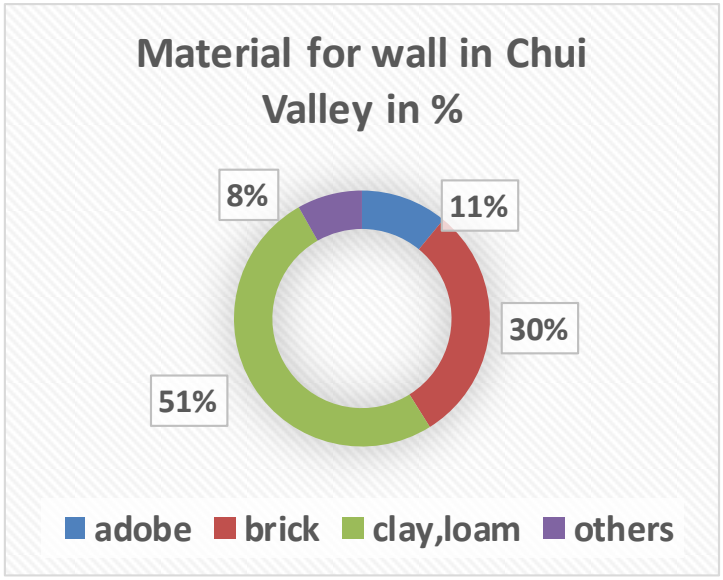
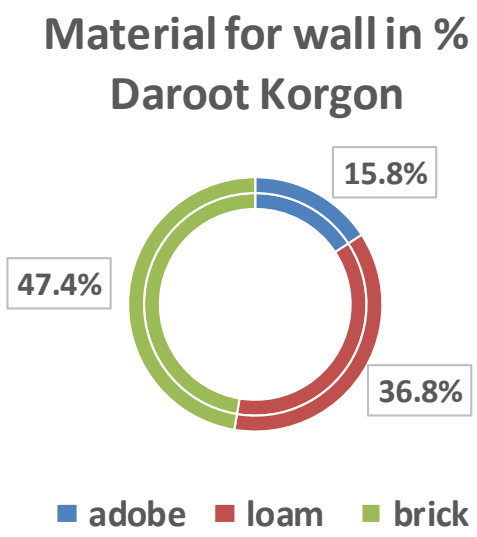
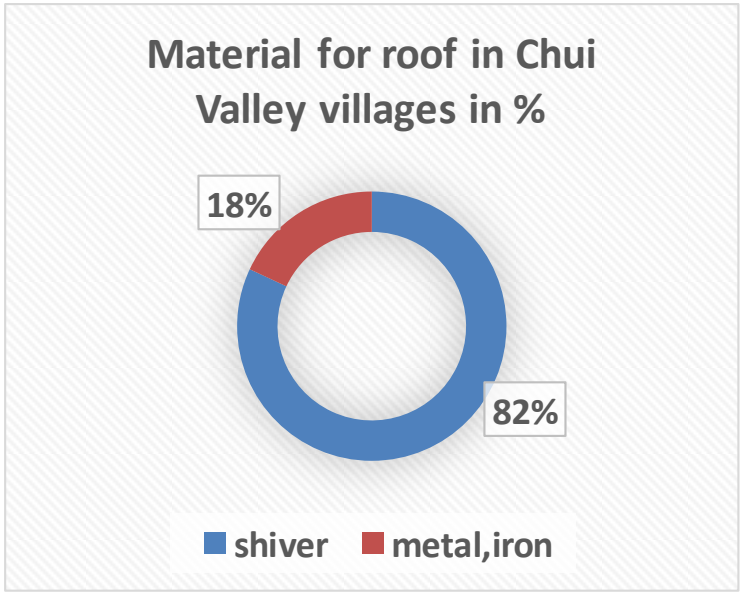
Results and Findings

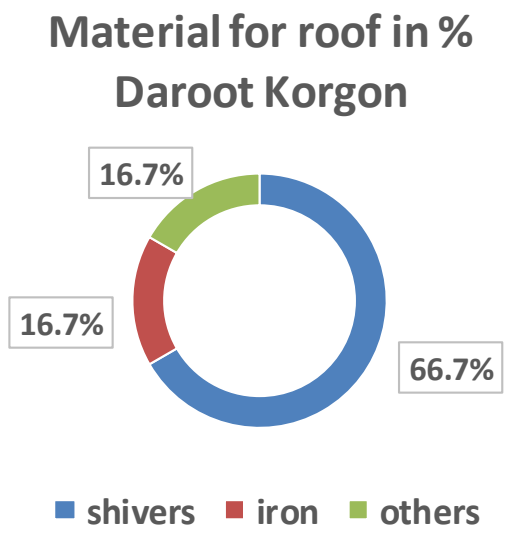




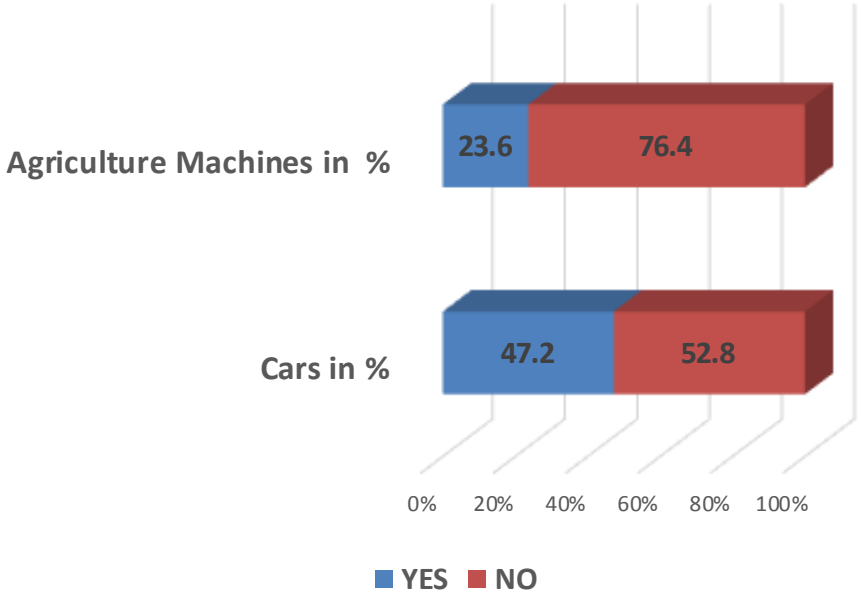

Material for wall in Chui Valley in %
8%
11%
30%
51%
adobe
brick
clay,loam
others


Material for wall in % Daroot Korgon
15.8%
47.4%
36.8%
adobe
loam
brick

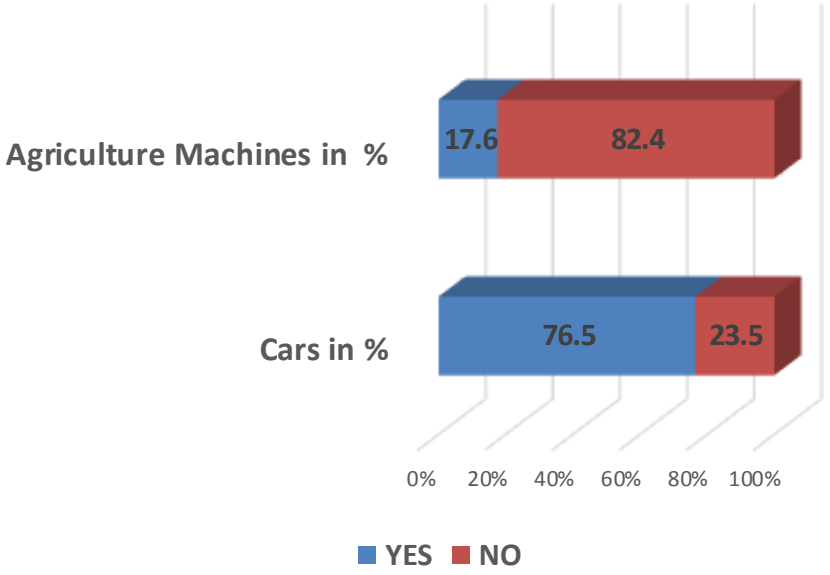

Material for roof in Chui Valley villages in %
18%
82%
shiver
metal,iron

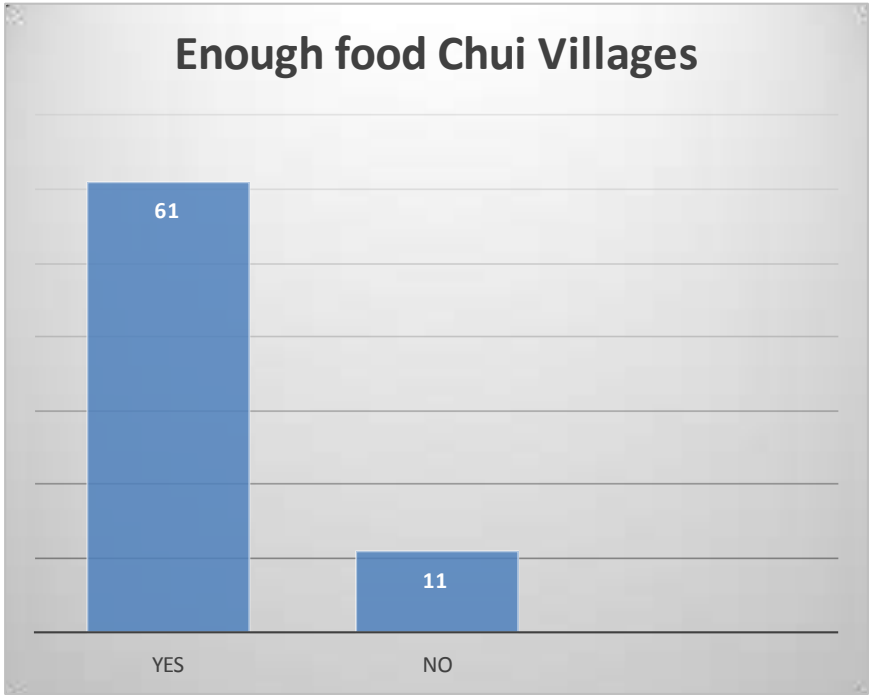

Material for roof in % Daroot Korgon
16.7%
16.7%
66.7%
shivers
iron
others

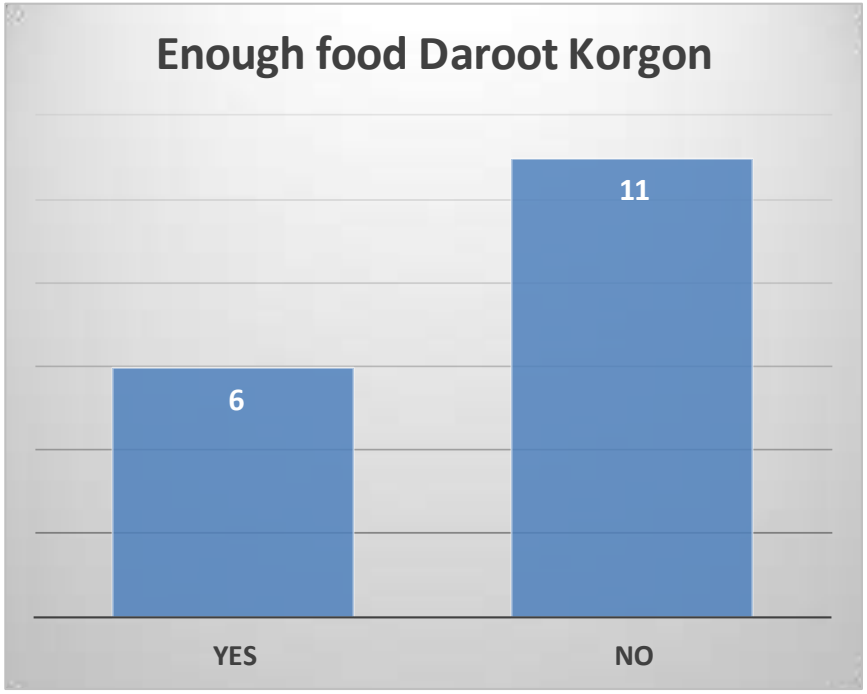
Chui Valley neighbourhoods



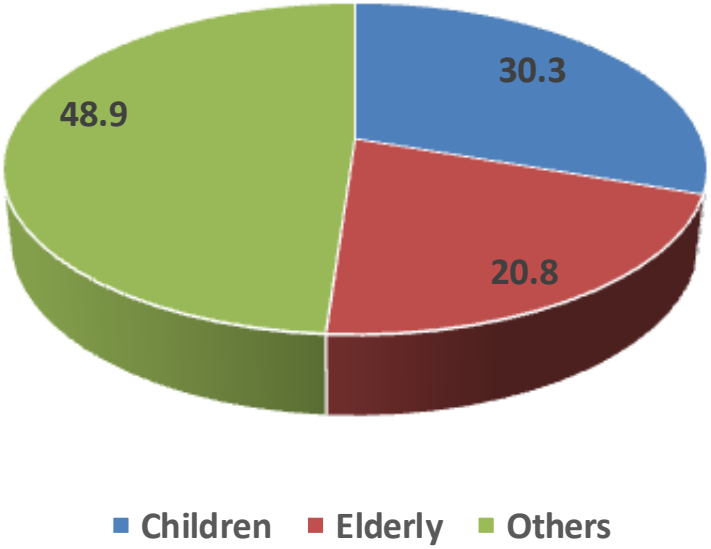
Chon Alay, Daroot Korgon



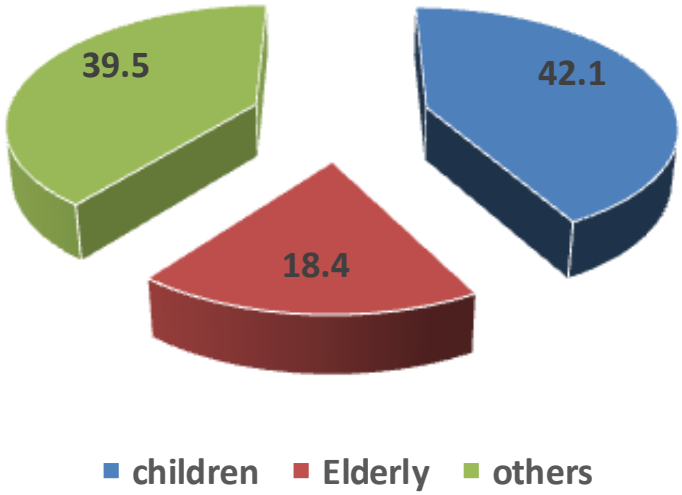

Enough food Chui Villages
61
11
YES
NO

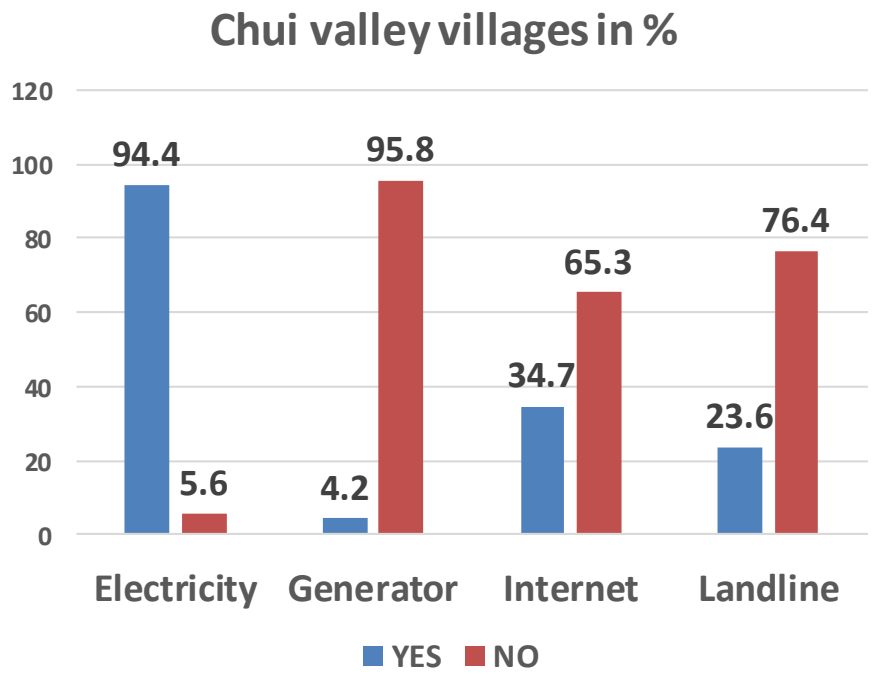

Enough food Daroot Korgon
6
11
YES
NO

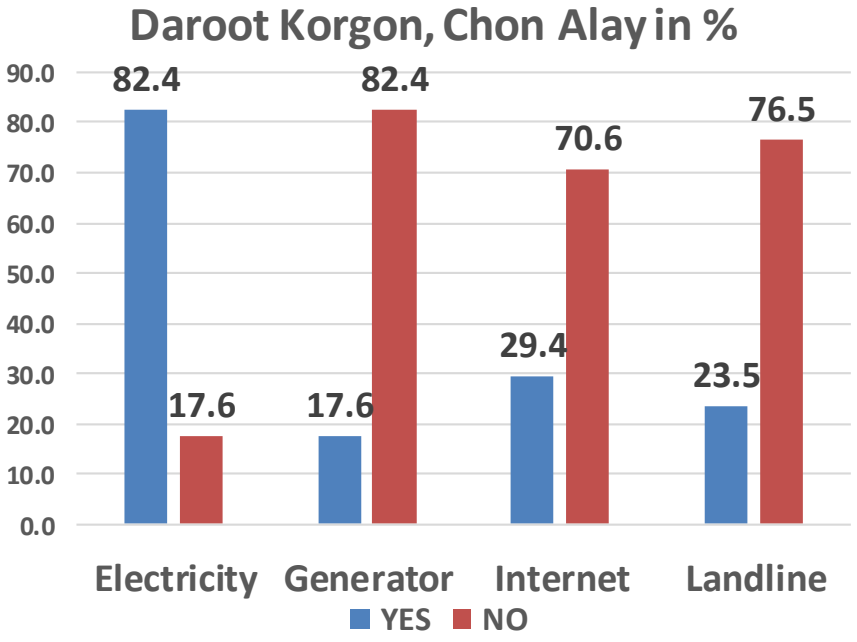
Chui VIllages number of household members



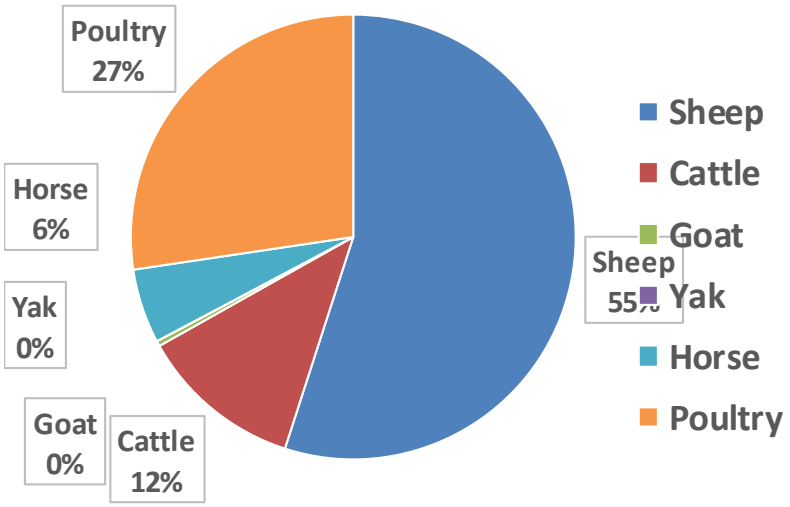
Chon Alay, Daroot Korgon number of household members



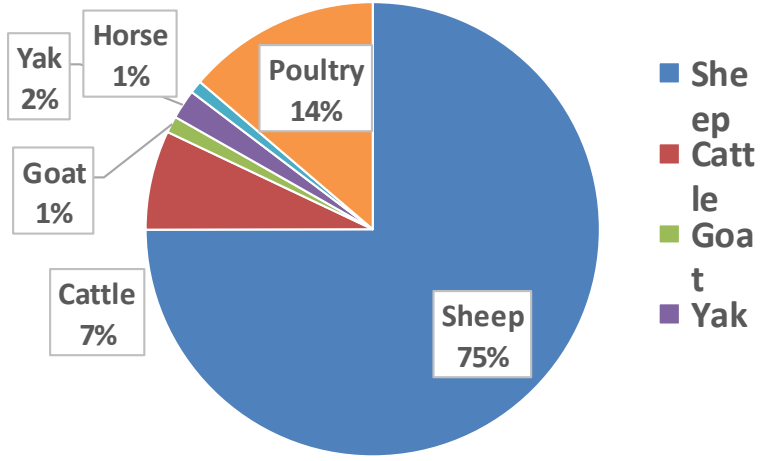

Chui valley villages in %
120
100
80
60
40
20
0
94.4
5.6
4.2
95.8
34.7
65.3
23.6
76.4
Electricity
Generator
Internet
Landline
YES
NO


Daroot Korgon, Chon Alay in %
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
82.4
17.6
17.6
82.4
29.4
70.6
23.5
76.5
Electricity
Generator
Internet
Landline
YES
NO

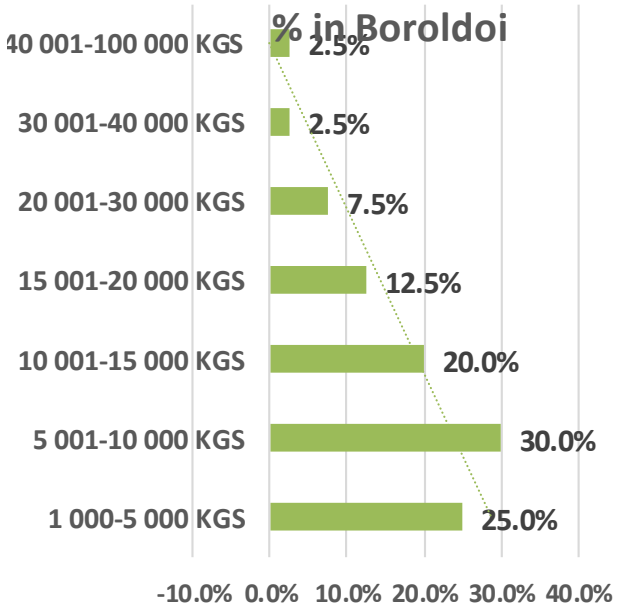
Number of livestock in Chui Villages in %



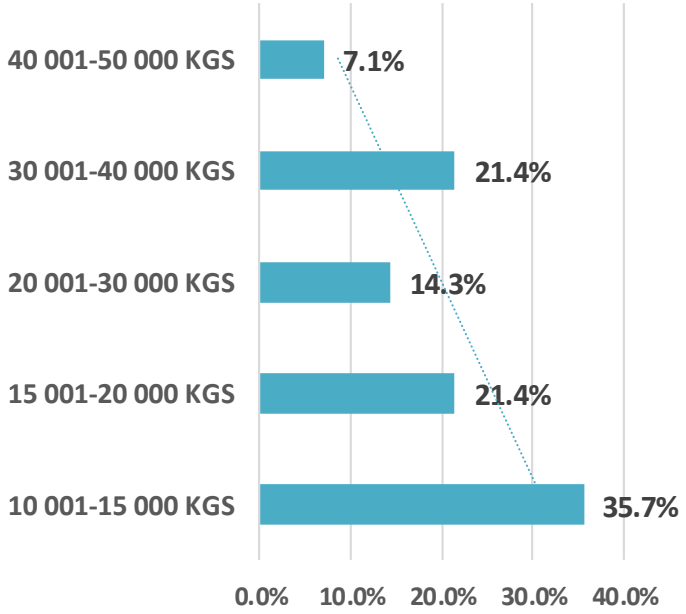
% Number of Livestocks in Chon Alay, Daroot Korgon



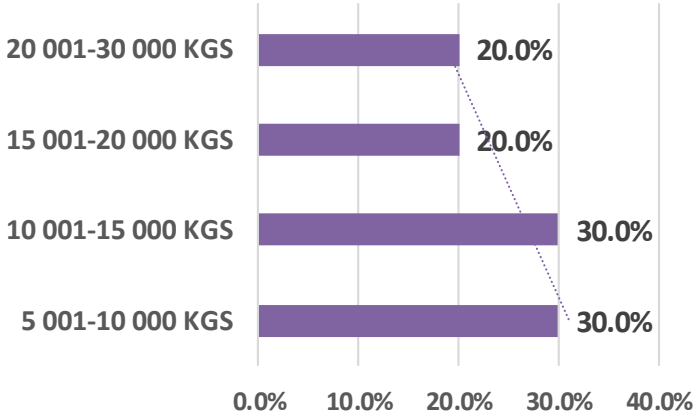
Income per household in % in Boroldoi



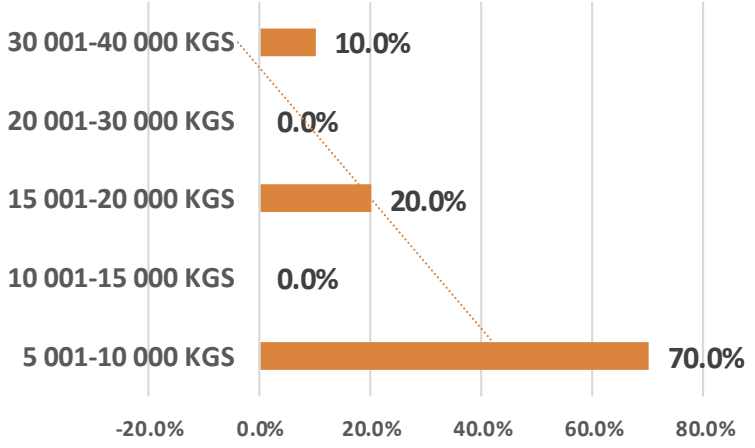
Income per household in % in Oirondu



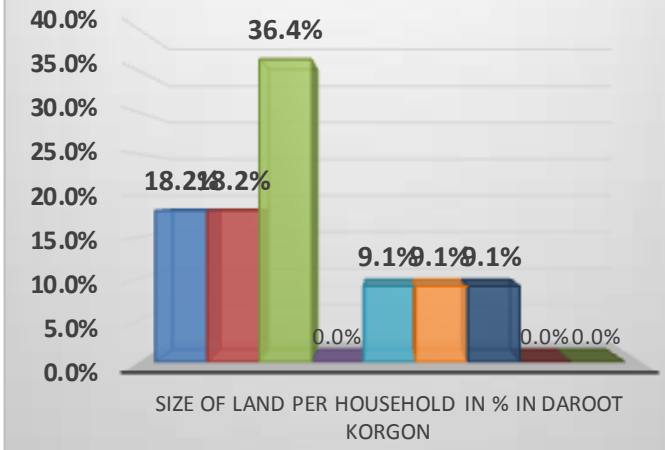
Income per household in % in Kuntuu



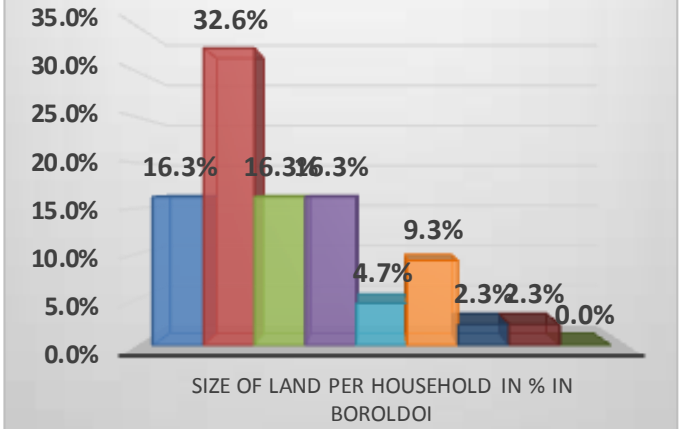
Income per household in % in Daroot Korgon



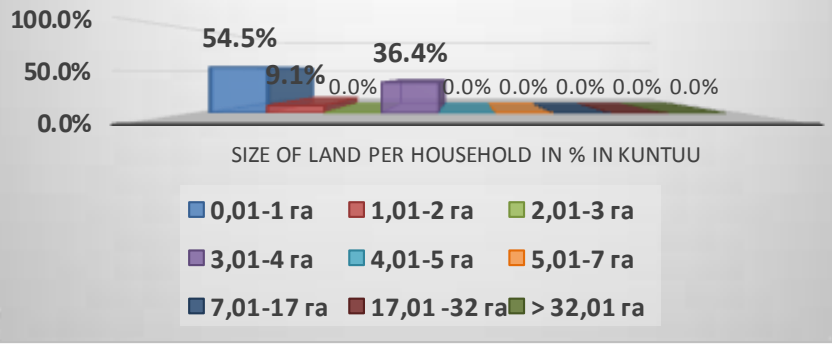
Size of land per household in % in Daroot Korgon



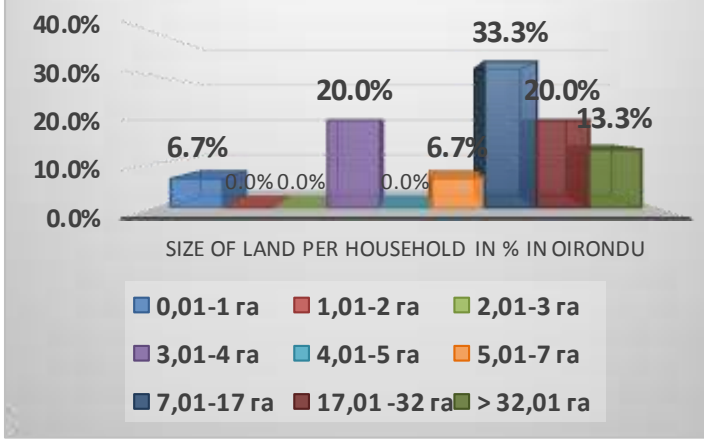
Size of land per household in % in Boroldoi

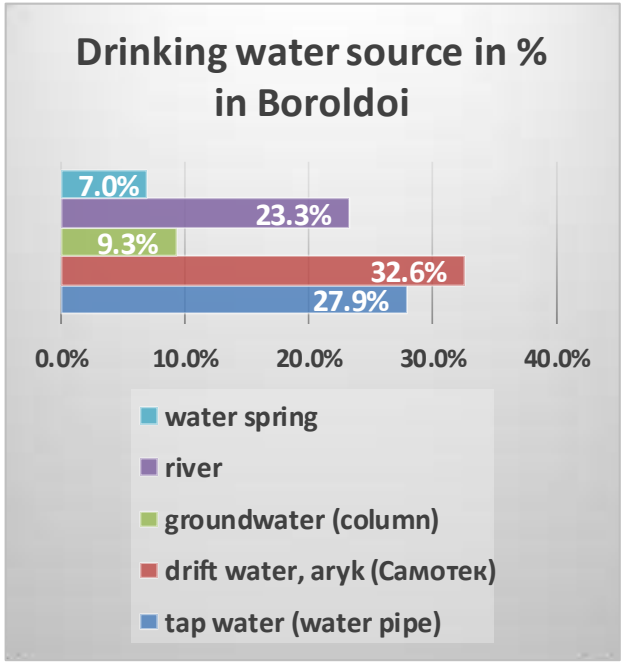


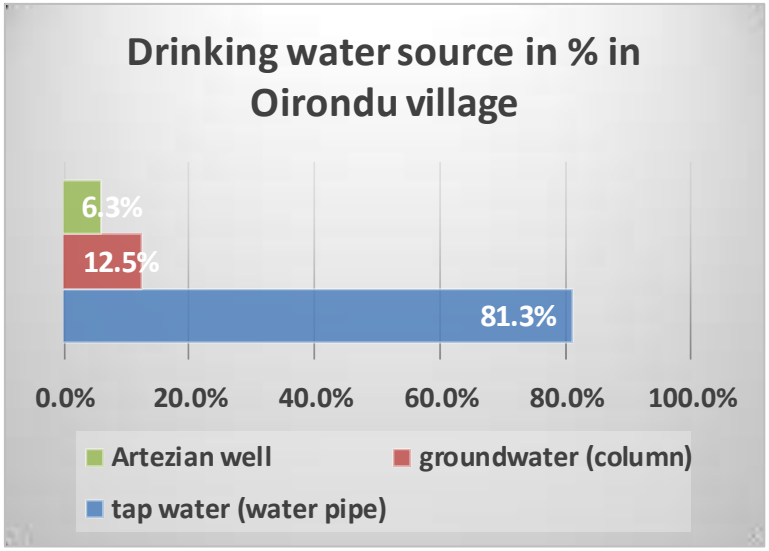
Size of land per household in % in Kuntuu

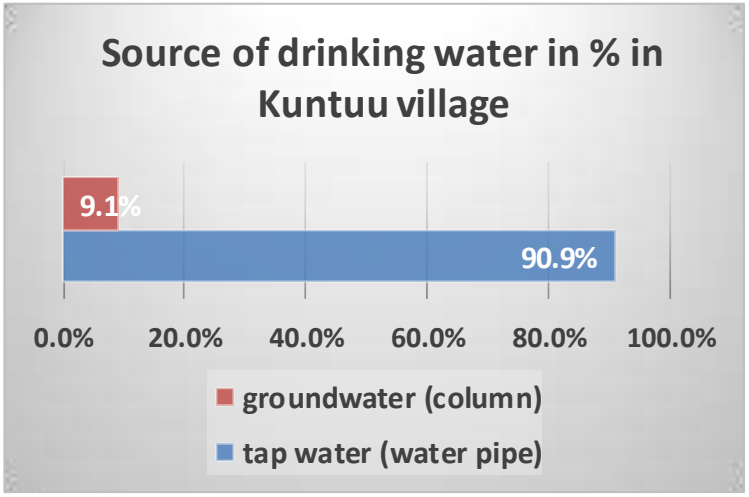


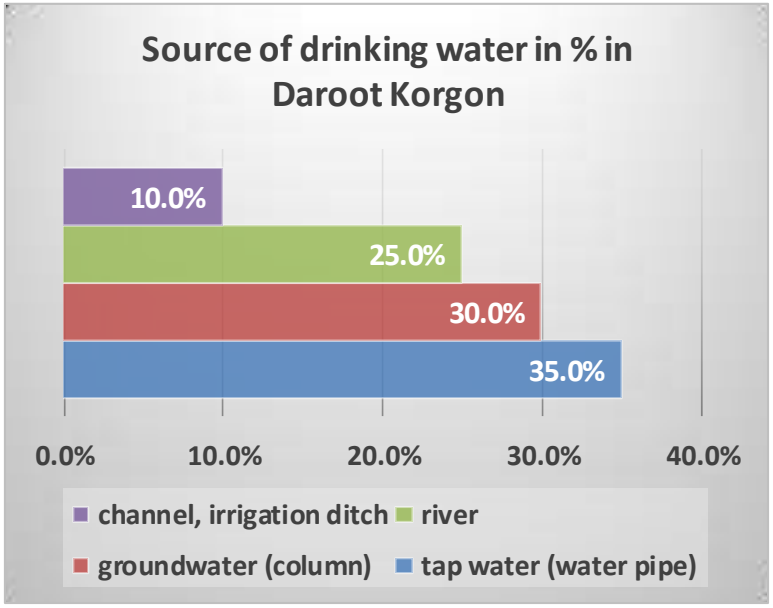
Size of land per household in % in Oirondu



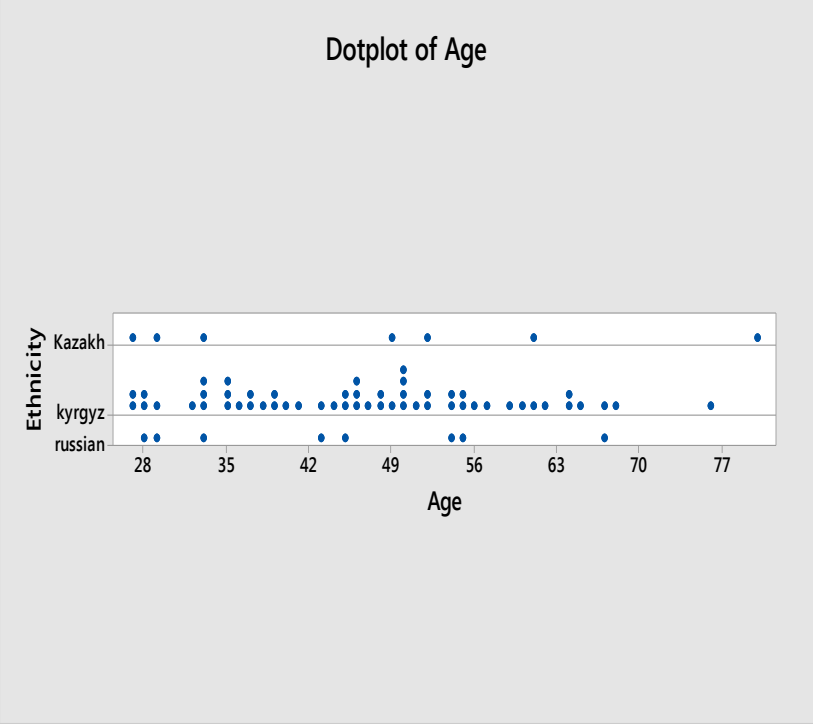

Drinking water source in % in Boroldoi
7.0%
23.3%
9.3%
32.6%
27.9%
0.0%
10.0%
20.0%
30.0%
40.0%
water spring
river
groundwater (column)
drift water, aryk (Самотек)
tap water (water pipe)

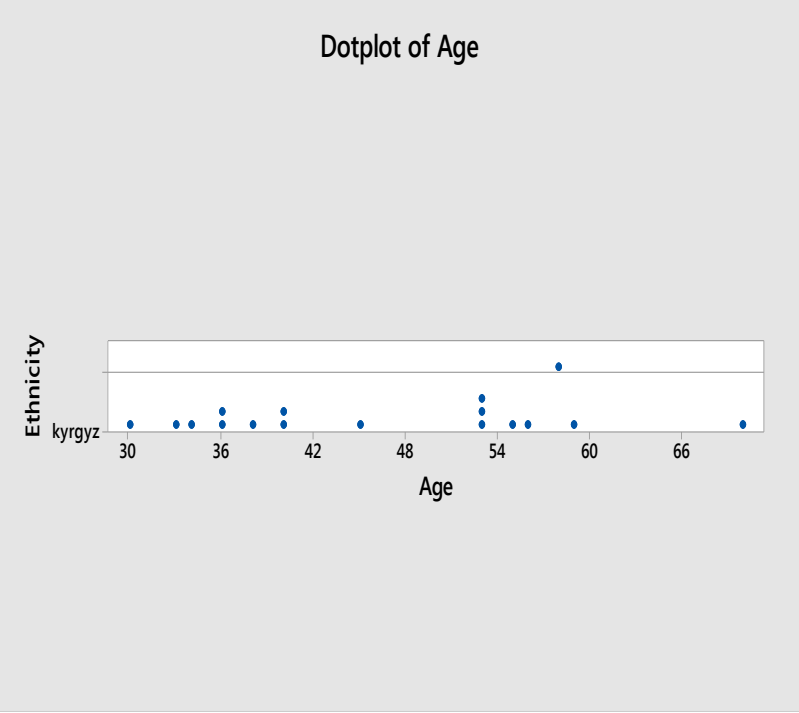

Drinking water source in % in Oirondu village
6.3%
12.5%
81.3%
0.0%
20.0%
40.0%
60.0%
80.0%
100.0%
Artezian well
groundwater (column)
tap water (water pipe)


Source of drinking water in % in Kuntuu village
9.1%
90.9%
0.0%
20.0%
40.0%
60.0%
80.0%
100.0%
groundwater (column)
tap water (water pipe)


Source of drinking water in % in Daroot Korgon
10.0%
25.0%
30.0%
35.0%
0.0%
10.0%
20.0%
30.0%
40.0%
channel, irrigation ditch
river
groundwater (column)
tap water (water pipe)

Descriptive statistics of ethnicity and age of respondents in Chui and Chon Alay valley





Conclusion

- Social vulnerability(water issues, food insuffiency)
- Presence of poor and rich class social disputes and tensions
- High dependence on agriculture and cattle breeding
- Poor quality of institutional and government support

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Tajikistan

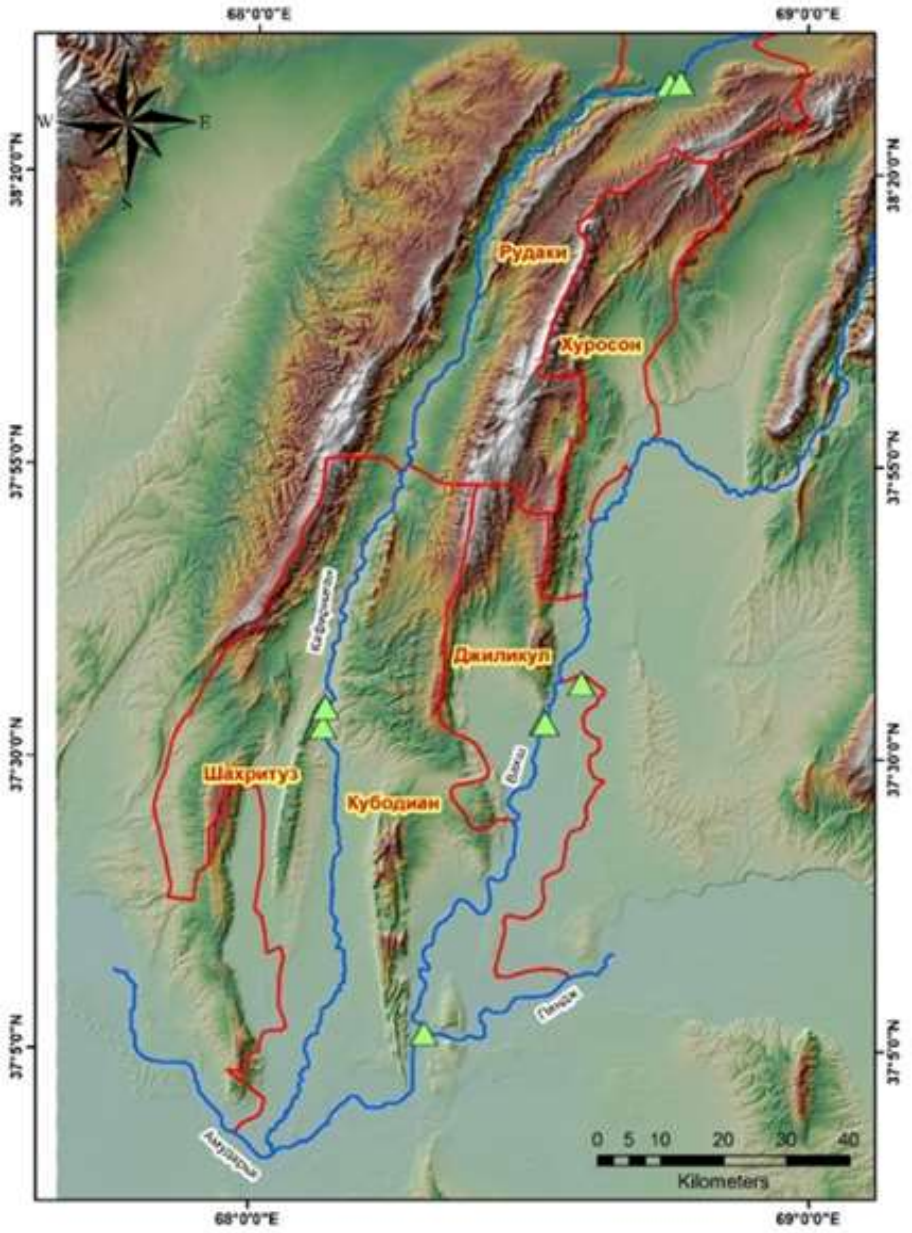
The workshop

The field trip

ENVIRONMENTAL ASSESSMENT OF THE KOFARNIHON RIVER BASIN USING SATELLITE IMAGES

MUNIM ABDUSAMADOV, ANVAR KODIROV, ZAMONIDDIN NASRIDDINOV, JAFAR NIYAZOV

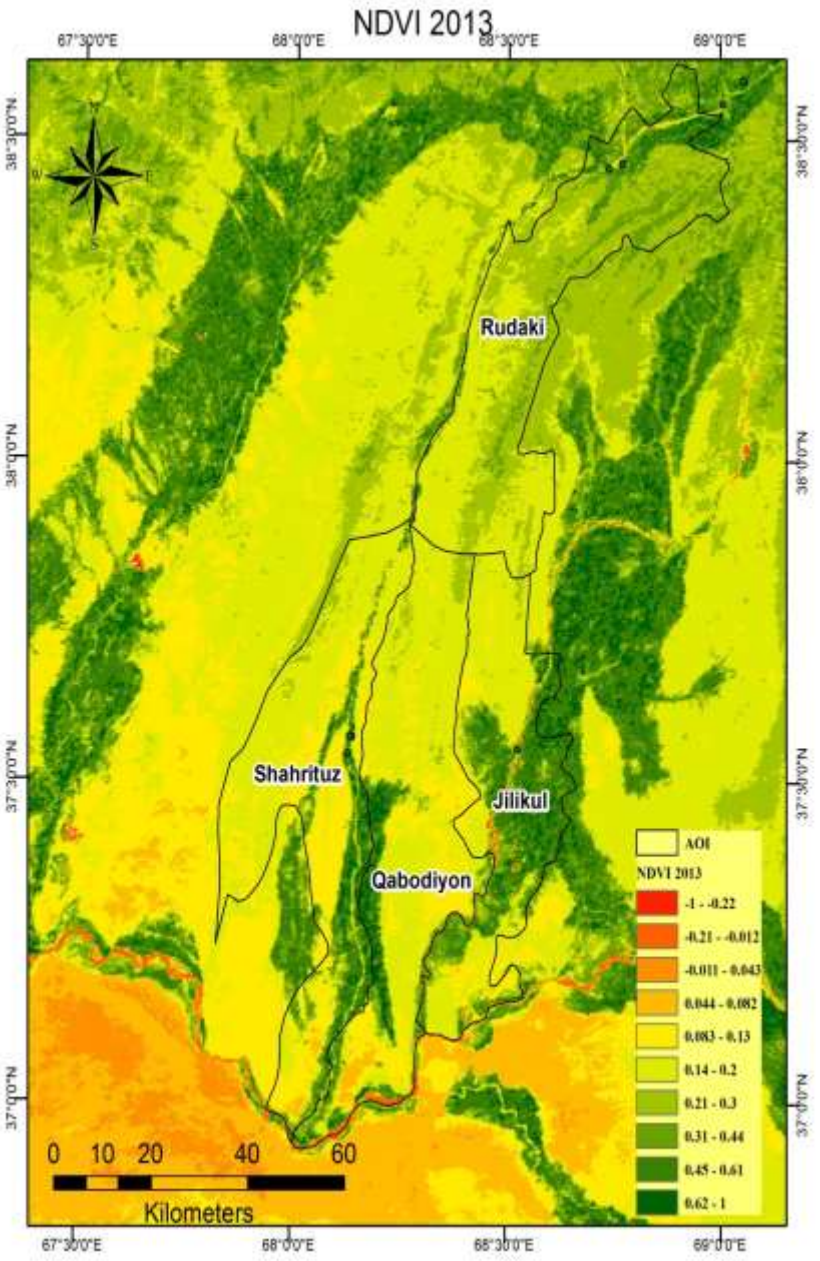
PEER NAS USAID «Integrated Water Resource Management and Strategic Environmental Assessment of Kabul and Amu Darya Rivers», American University of Central Asia, Bishkek, Kyrgyz Republic, on 10-15 October, 2018

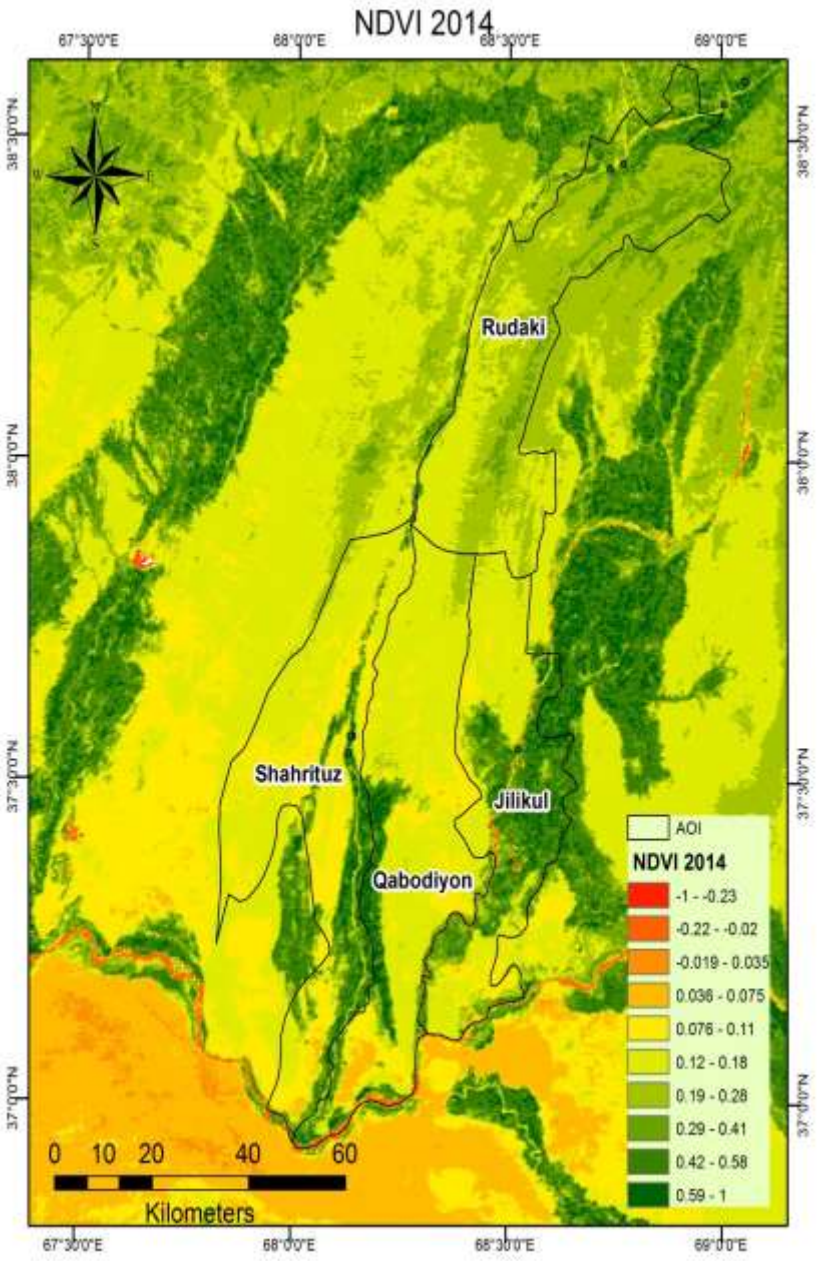


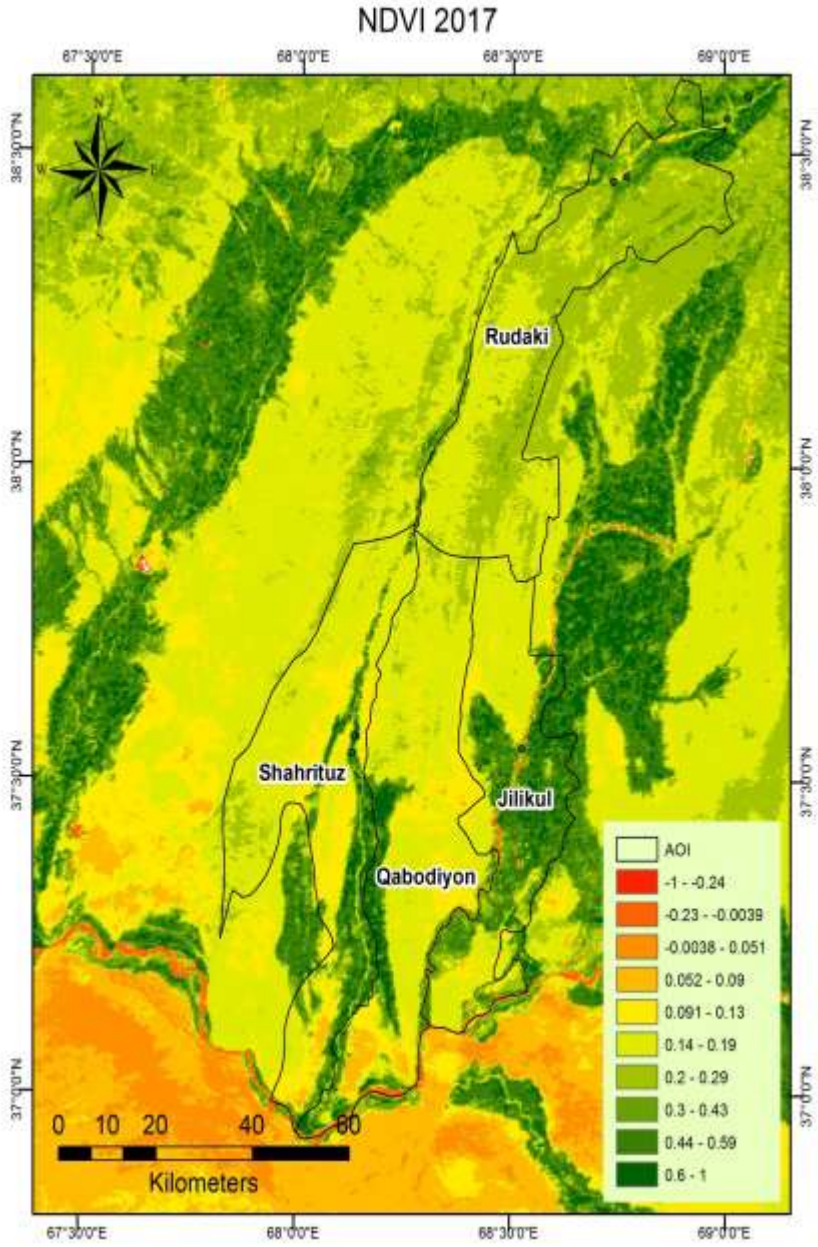
The objects detection and definition on the Earth's surface useful to combine different bands to produce so-called images in natural colors or pseudo-color images. The semi-automatic extraction of objects of interest (vegetation, water bodies etc.) includes the construction of the ratio of different bands. The allocation of vegetation-covered areas by calculating the normalized difference vegetation index NDVI is widespread:

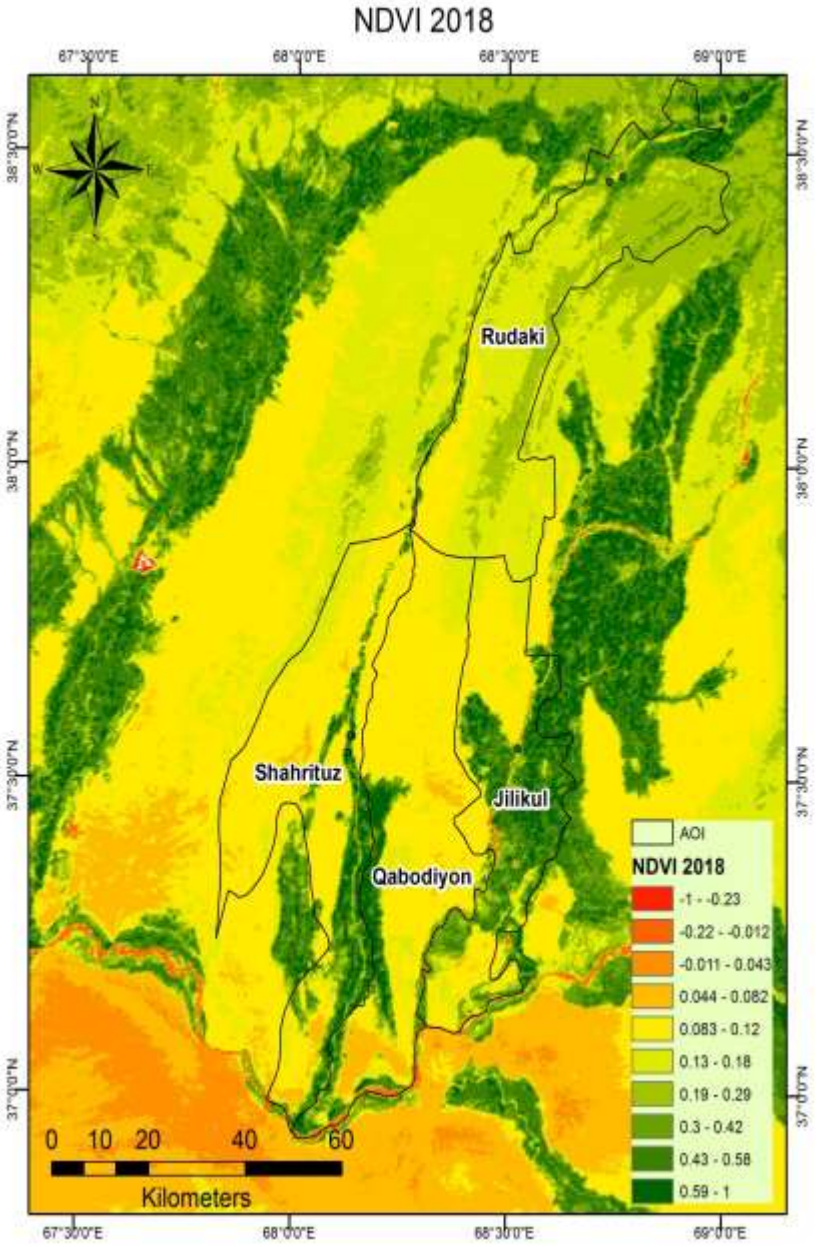
$$NDVI = \frac{NIR - RED}{NIR + RED},$$

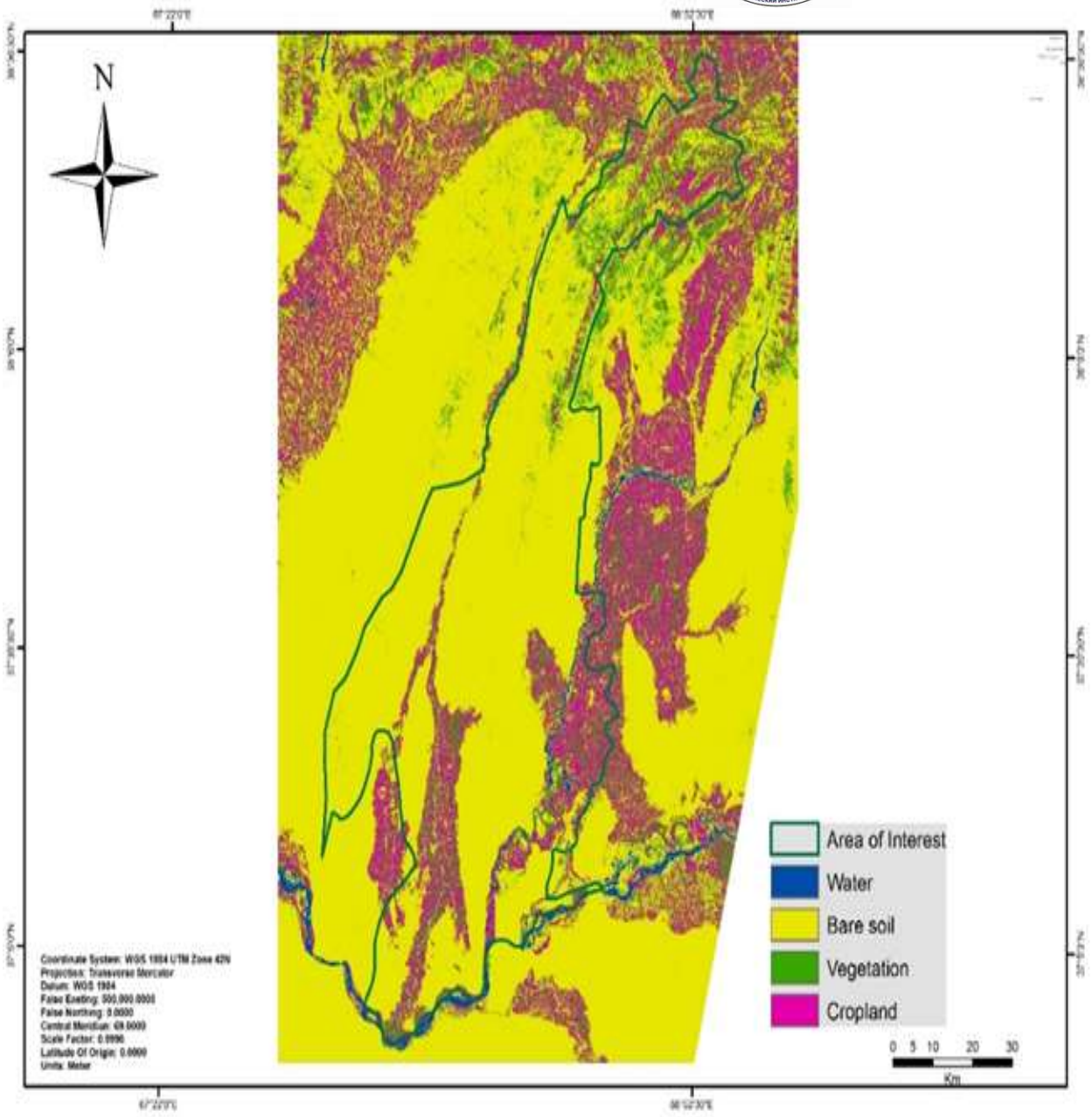
For the Landsat 8 images NIR is band 5, and RED is band 4.
The range of NDVI values varies from -1 to 1, with the highest values indicating lush vegetation and the lowest values indicating rare vegetation cover. NDVI values should be classified in order to clearly identify vegetation-covered areas. Should define equal values for the classified NDVI visualization separately for each satellite image scene to calculate the difference between them.


NDVI 2013
Rudaki
Shahrituz
Jilikul
Qabodiyon
AOI
NDVI 2013
-1 - -0.22
-0.21 - -0.012
-0.011 - 0.043
0.044 - 0.082
0.083 - 0.13
0.14 - 0.2
0.21 - 0.3
0.31 - 0.44
0.45 - 0.61
0.62 - 1
0 10 20 40 60
Kilometers

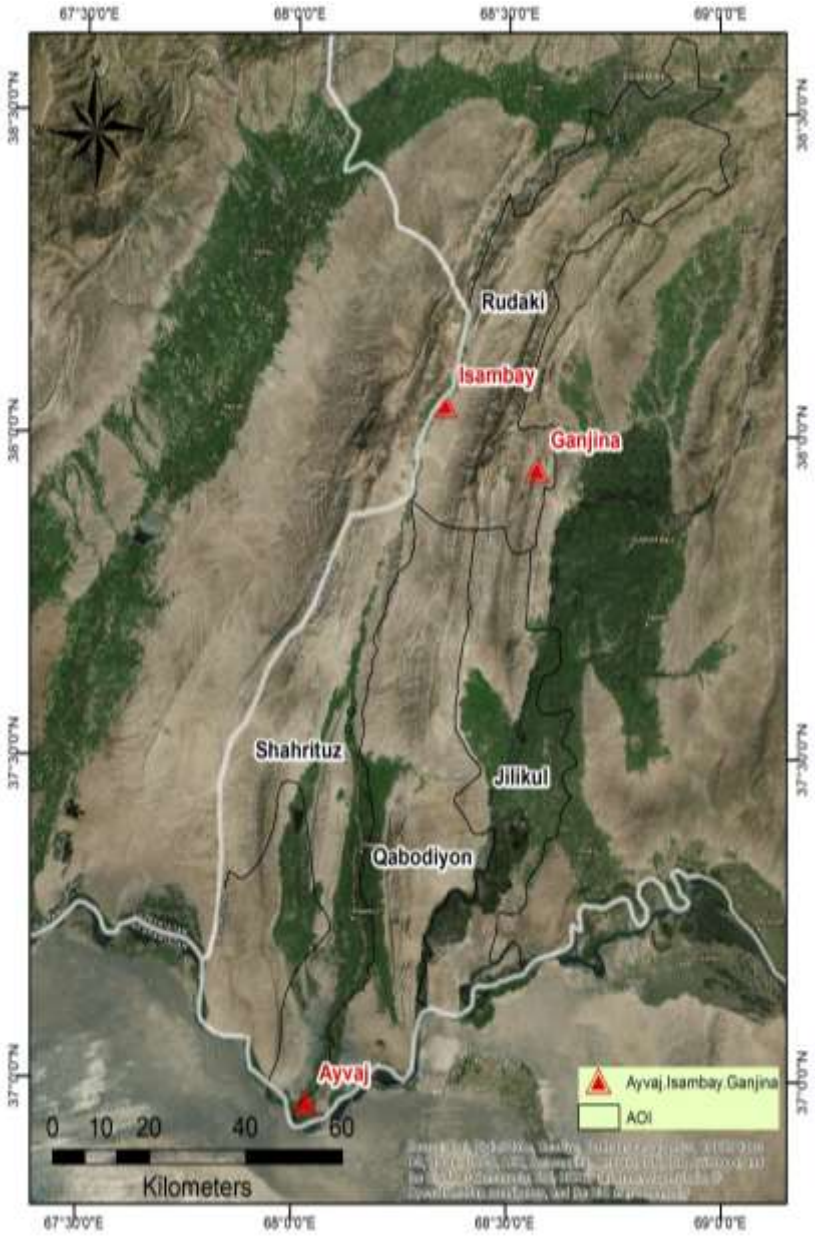

NDVI 2014
Rudaki
Shahrituz
Jilikul
Qabodiyon
AOI
NDVI 2014
-1 - -0.23
-0.22 - -0.02
-0.019 - 0.035
0.036 - 0.075
0.076 - 0.11
0.12 - 0.18
0.19 - 0.28
0.29 - 0.41
0.42 - 0.58
0.59 - 1
0 10 20 40 60
Kilometers

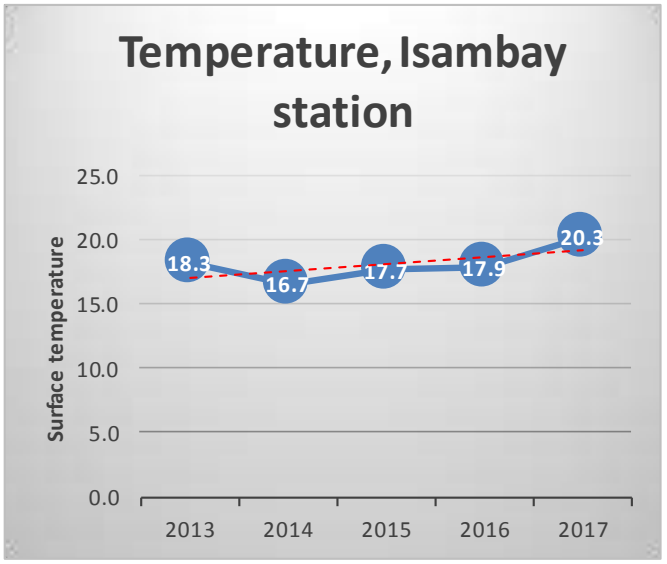

NDVI 2017
67°30'0"E
68°0'0"E
68°30'0"E
69°0'0"E
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
Rudaki
Shahrituz
Jilikul
Qabodiyon
0 10 20 40 60
Kilometers
AOI
-1 - -0.24
-0.23 - -0.0039
-0.0038 - 0.051
0.052 - 0.09
0.091 - 0.13
0.14 - 0.19
0.2 - 0.29
0.3 - 0.43
0.44 - 0.59
0.6 - 1

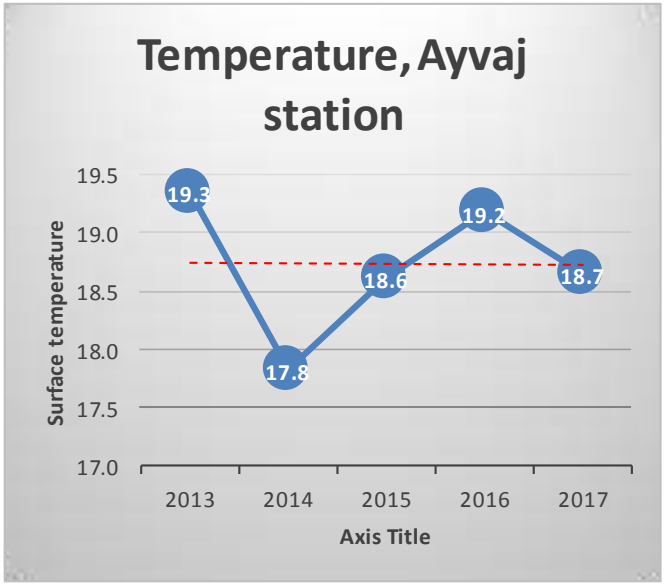

NDVI 2018
67°30'0"E
68°0'0"E
68°30'0"E
69°0'0"E
38°30'0"N
38°0'0"N
37°30'0"N
37°0'0"N
Rudaki
Shahrituz
Jilikul
Qabodiyon
0 10 20 40 60
Kilometers
AOI
NDVI 2018
-1 - -0.23
-0.22 - -0.012
-0.011 - 0.043
0.044 - 0.082
0.083 - 0.12
0.13 - 0.18
0.19 - 0.29
0.3 - 0.42
0.43 - 0.58
0.59 - 1

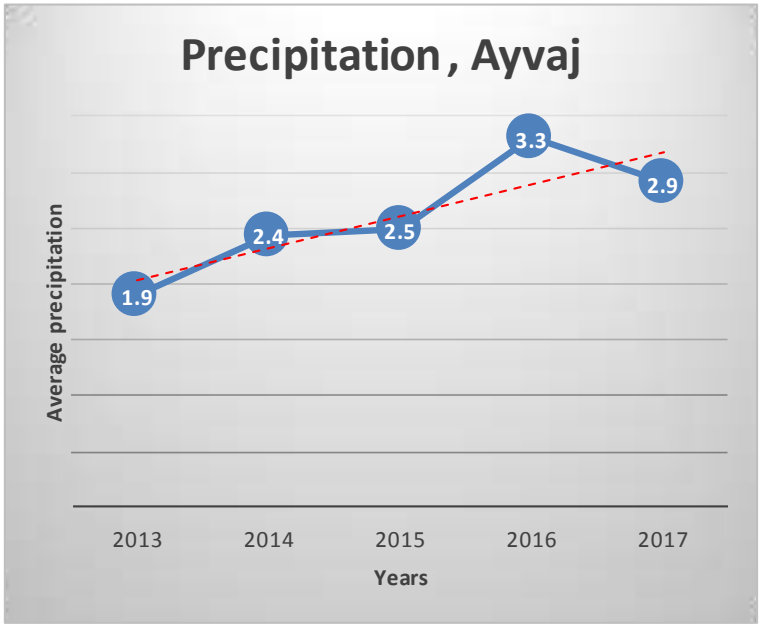


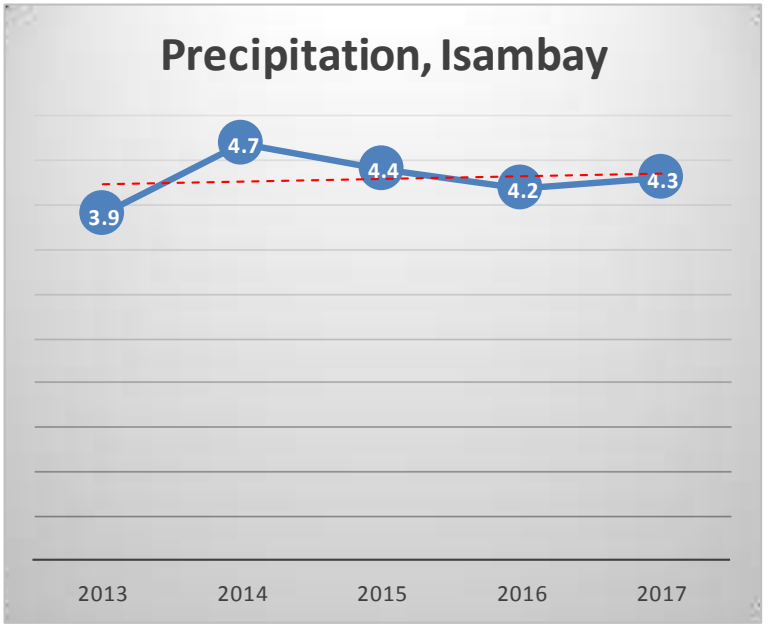
Land cover (LC) can be defined as the "observed (bio) physical cover of the earth's surface" and is a synthesis of the many processes taking place on the land. It reflects land occupation (and its transformation) by various natural, modified or artificial systems and to some extent how these systems affect the land. LC is one of the most easily detectable indicators of human intervention on land. Because it can change quickly over time, it is also a good proxy for dynamics of the earth surface resulting from a variety of drivers and factors.

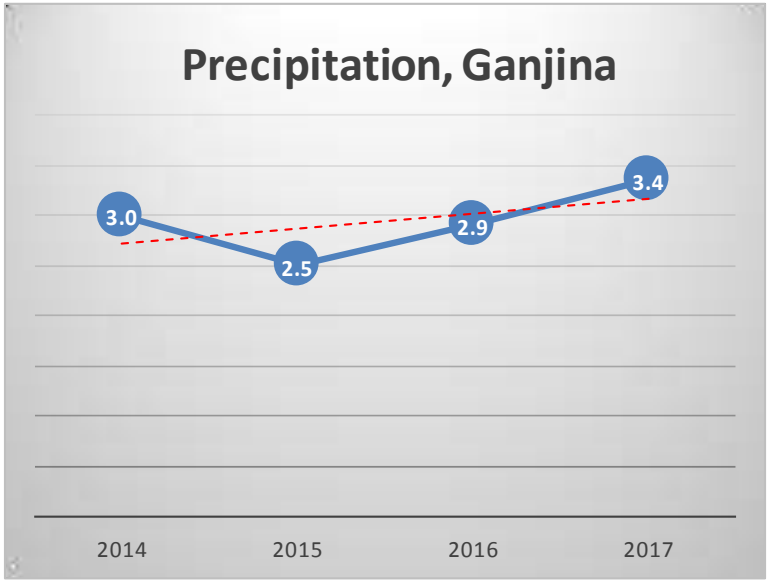

Rudaki
Isambay
Ganjina
Shahrituz
Jilikul
Qabodiyon
Ayvaj
Ayvaj,Isambay,Ganjina
AOI
0 10 20 40 60
Kilometers

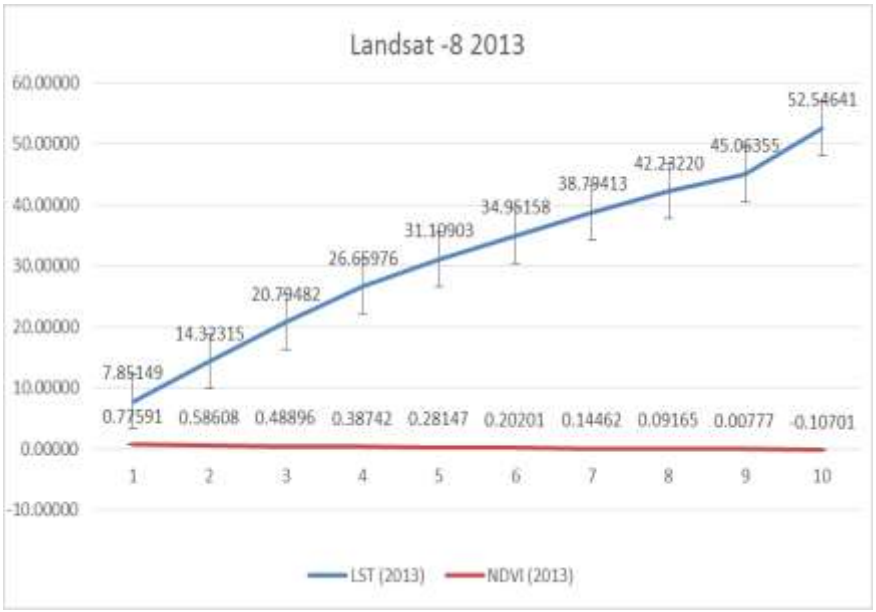

Temperature, Isambay station
Surface temperature
25.0
20.0
15.0
10.0
5.0
0.0
18.3
16.7
17.7
17.9
20.3
2013
2014
2015
2016
2017

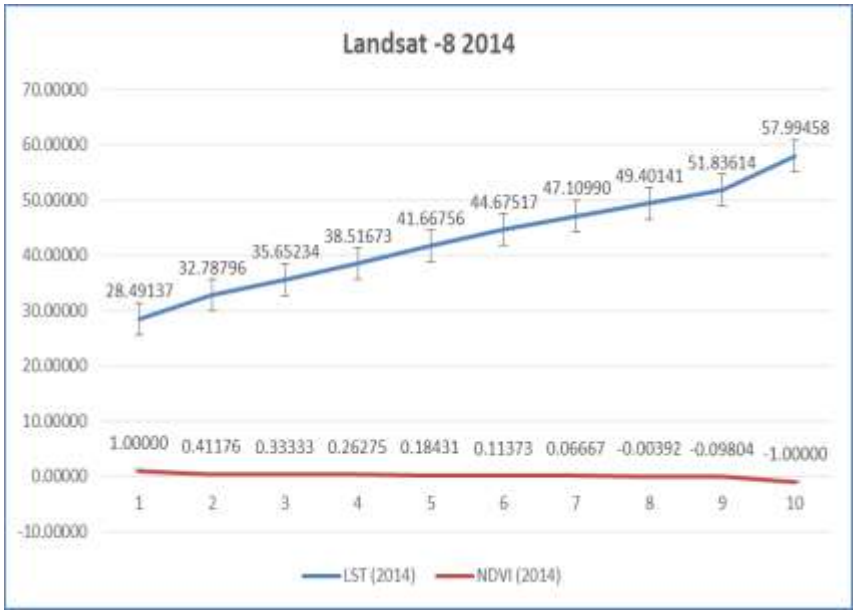

Temperature, Ayvaj station
Surface temperature
19.5
19.0
18.5
18.0
17.5
17.0
19.3
17.8
18.6
19.2
18.7
2013
2014
2015
2016
2017
Axis Title

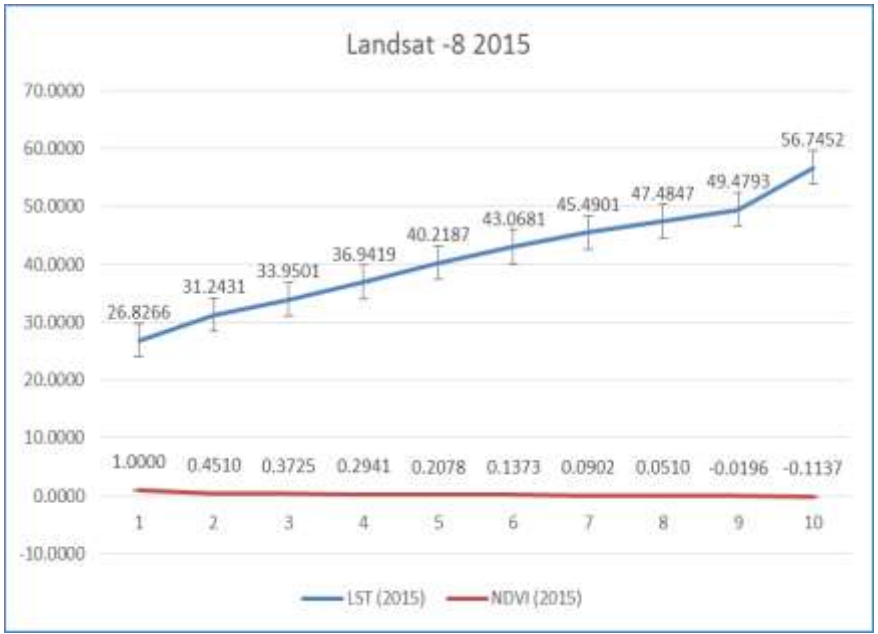

Precipitation , Ayvaj
Average precipitation
1.9
2.4
2.5
3.3
2.9
2013
2014
2015
2016
2017
Years

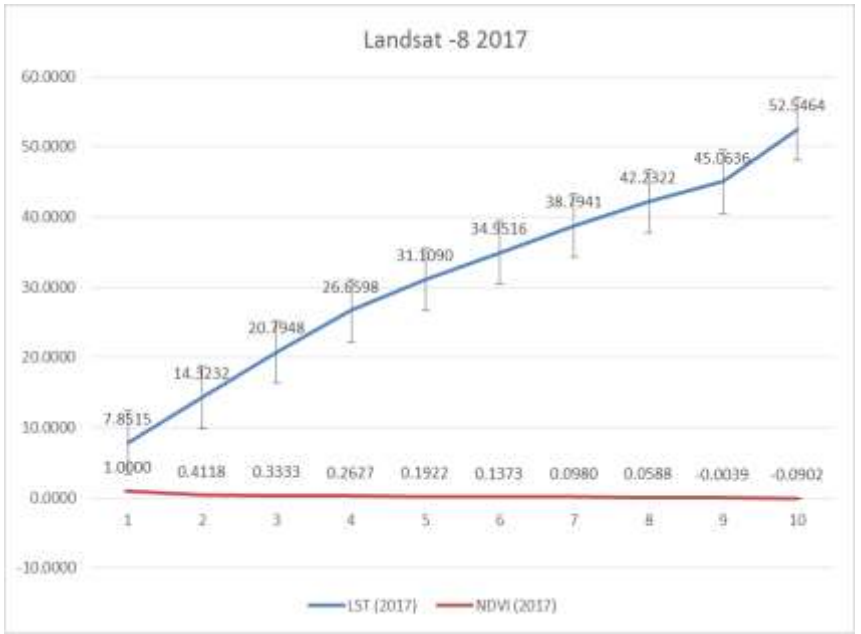

Precipitation, Isambay
3.9
4.7
4.4
4.2
4.3
2013
2014
2015
2016
2017


Precipitation, Ganjina
3.0
2.5
2.9
3.4
2014
2015
2016
2017


Landsat -8 2013
60.00000
50.00000
40.00000
30.00000
20.00000
10.00000
0.00000
-10.00000
7.85149
14.32315
20.79482
26.66976
31.10903
34.96158
38.79413
42.23220
45.06355
52.54641
0.77591 0.58608 0.48896 0.38742 0.28147 0.20201 0.14462 0.09165 0.00777 -0.10701
1 2 3 4 5 6 7 8 9 10
LST (2013)
NDVI (2013)


Landsat -8 2014
70.00000
60.00000
50.00000
40.00000
30.00000
20.00000
10.00000
0.00000
-10.00000
28.49137
32.78796
35.65234
38.51673
41.66756
44.67517
47.10990
49.40141
51.83614
57.99458
1.00000 0.41176 0.33333 0.26275 0.18431 0.11373 0.06667 -0.00392 -0.09804 -1.00000
1 2 3 4 5 6 7 8 9 10
LST (2014)
NDVI (2014)


Landsat -8 2015
70.0000
60.0000
50.0000
40.0000
30.0000
20.0000
10.0000
0.0000
-10.0000
26.8266
31.2431
33.9501
36.9419
40.2187
43.0681
45.4901
47.4847
49.4793
56.7452
1.0000 0.4510 0.3725 0.2941 0.2078 0.1373 0.0902 0.0510 -0.0196 -0.1137
1 2 3 4 5 6 7 8 9 10
LST (2015)
NDVI (2015)


Landsat -8 2017
60.0000
50.0000
40.0000
30.0000
20.0000
10.0000
0.0000
-10.0000
7.8515
14.3232
20.7948
26.6598
31.1090
34.9516
38.7941
42.2322
45.0636
52.5464
1.0000 0.4118 0.3333 0.2627 0.1922 0.1373 0.0980 0.0588 -0.0039 -0.0902
1 2 3 4 5 6 7 8 9 10
LST (2017)
NDVI (2017)

CONCLUSION

Studies conducted in the Amu Darya river basin have shown the need to introduce water-saving irrigation technologies, integrated water resources management, improvement of the ecological status of Transboundary Rivers, socio-economic living conditions of the population and improve the efficiency of irrigated land use.

In addition, specific recommendations for the study, planning and implementation of the effective use of water resources of the partner countries will be developed and presented.

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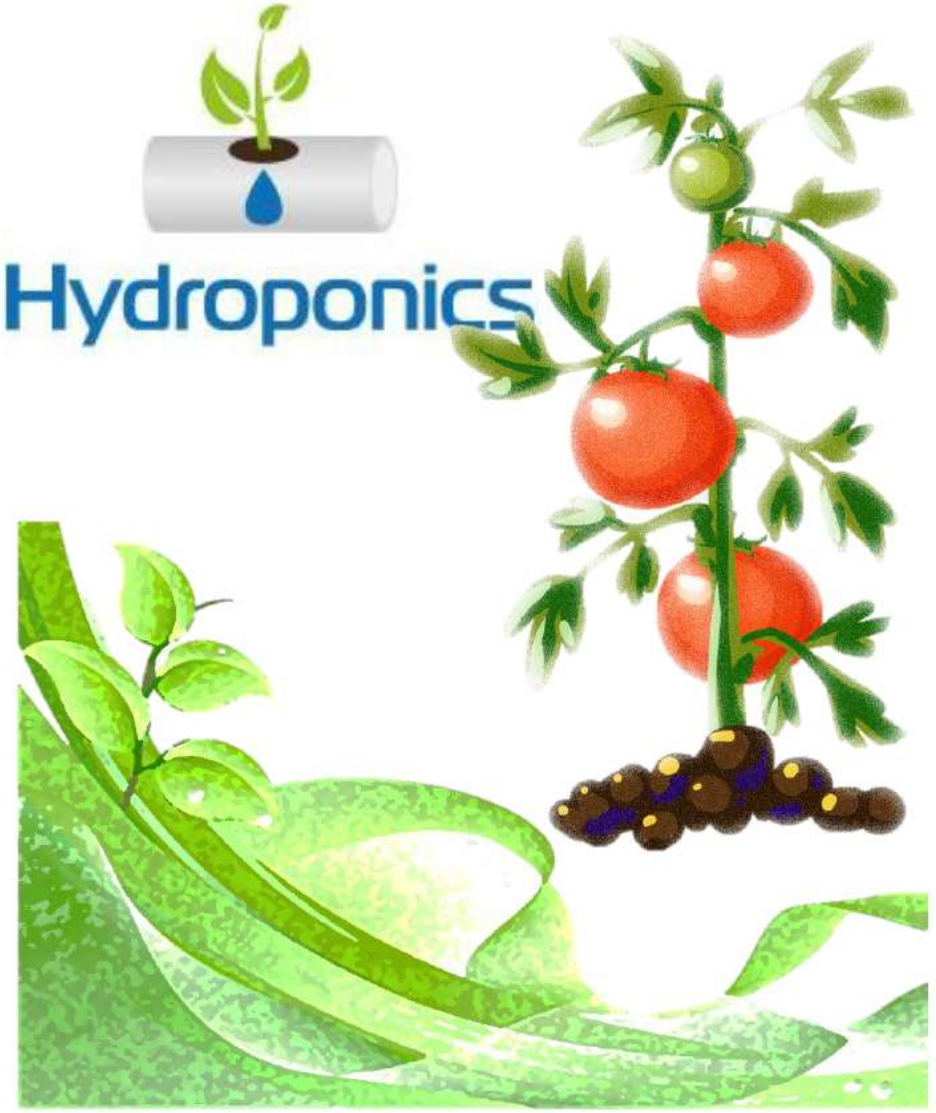
WATERSAVING TECHNOLOGIES:

HYDROPONICS ON THE BASIS OF BASALT CLOTH,

EXPERIENCE FROM THE REPUBLIC OF TAJIKISTAN



GOOD PRACTICE

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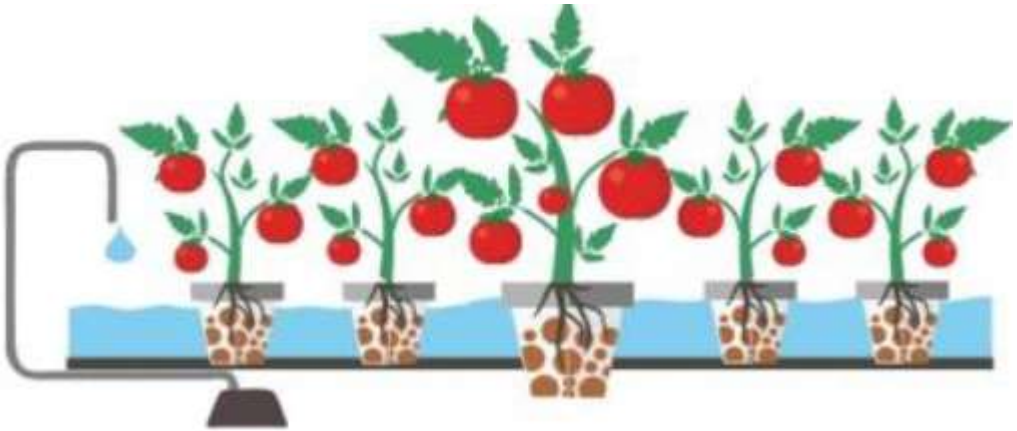

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ДОНИШКАДАИ КӮХИ-МЕТАЛЛУРГИИ ТОҶИКИСТОН
ГОРНО-МЕТАЛЛУРГИЧЕСКИЙ ИНСТИТУТ ТАДЖИКИСТАНА

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The Workshop

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The field trip

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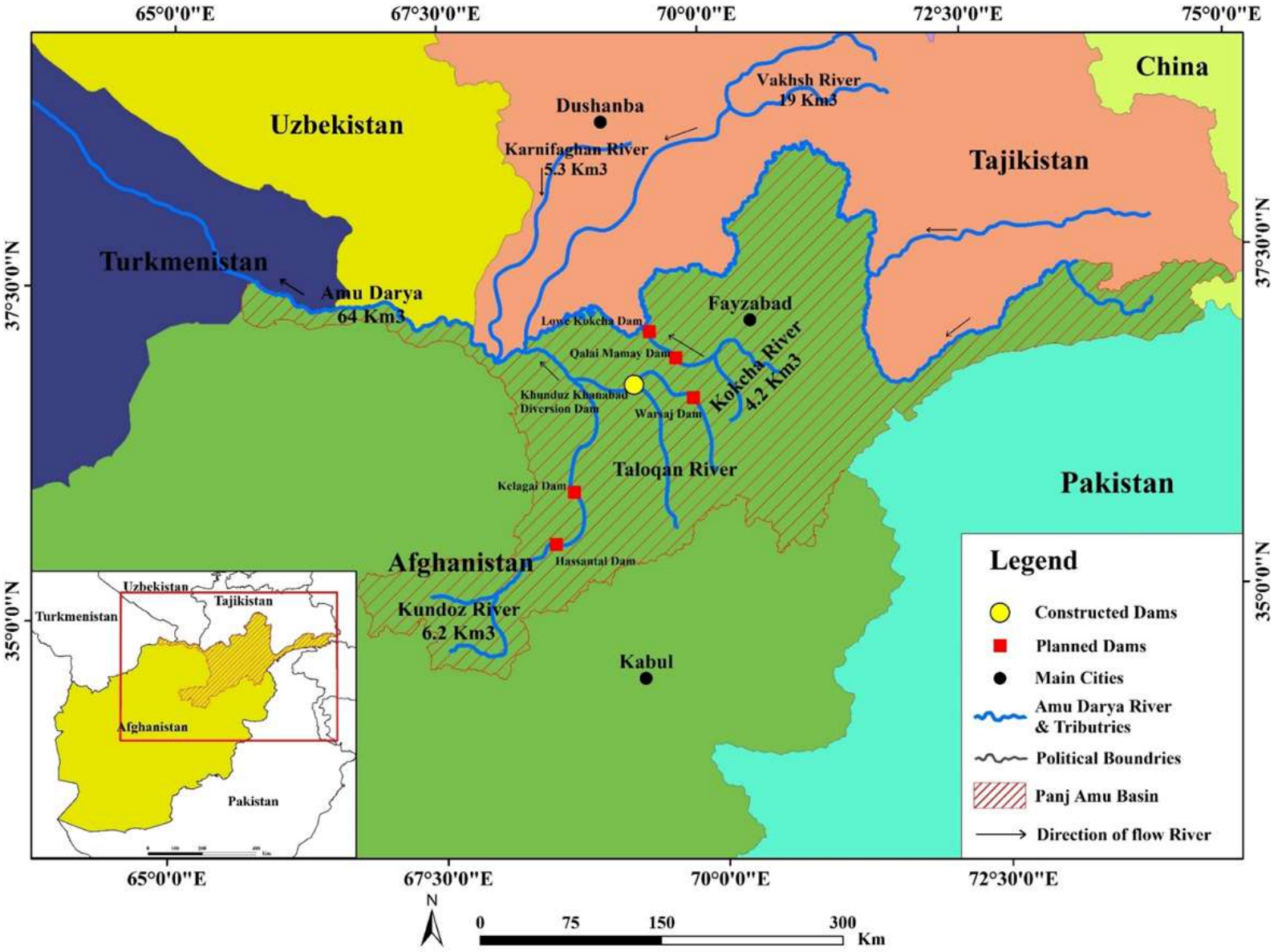
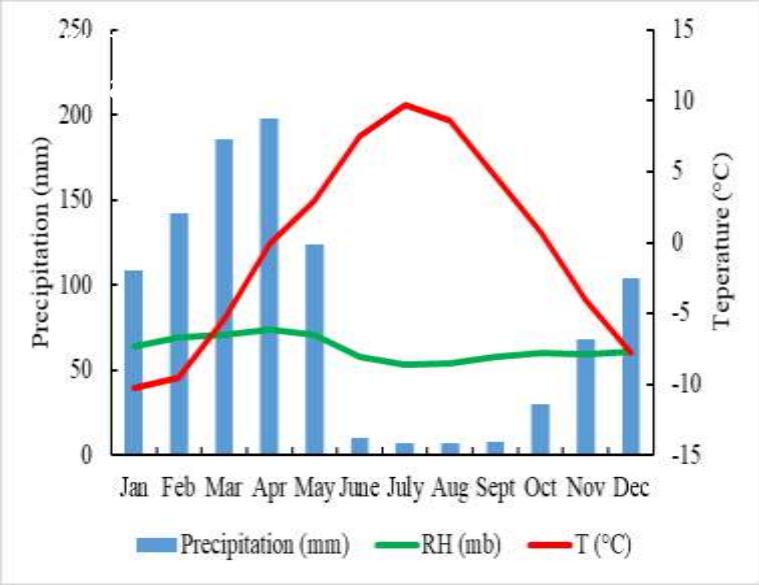
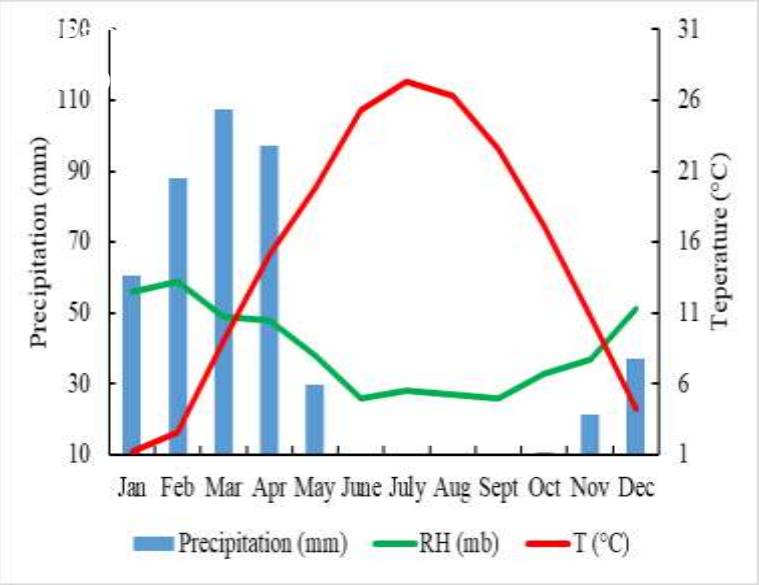
Amu Darya River Basin



Climate





Kundoz River Basin (North Salang Hydrologic Station)													
Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Mean Annual Temperature (°C)	-10.30	-9.50	-5.40	-0.10	2.90	7.50	9.70	8.60	4.70	0.70	-4.00	-7.80	-0.20
Precipitation (mm)	108.70	142.00	185.90	197.80	123.70	10.00	6.80	6.70	7.50	30.20	68.40	104.30	82.70
Relative Humidity (mb)	64.00	69.00	71.00	74.00	71.00	58.00	53.00	54.00	58.00	60.00	59.00	61.00	62.00
Atomospheric Pressure (mb)	673.20	672.50	674.80	677.20	678.70	678.90	678.30	679.00	680.10	680.30	678.30	675.50	677.20

Panjshir River Basin (Jabalusaraj Hydrologic Station)													
Month	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
Mean Annual Temperature (°C)	1.20	2.60	9.00	15.10	19.80	25.30	27.30	26.30	22.60	17.20	10.70	4.20	15.30
Precipitation (mm)	60.70	88.00	107.60	97.20	29.80	1.40	3.00	2.10	3.30	10.70	21.20	37.20	38.50
Relative Humidity (mb)	56.00	59.00	49.00	48.00	38.00	26.00	28.00	27.00	26.00	33.00	37.00	51.00	39.00
Atomospheric Pressure (mb)	840.90	840.00	839.20	838.20	836.50	833.30	831.10	832.40	836.30	840.30	842.00	842.00	837.50

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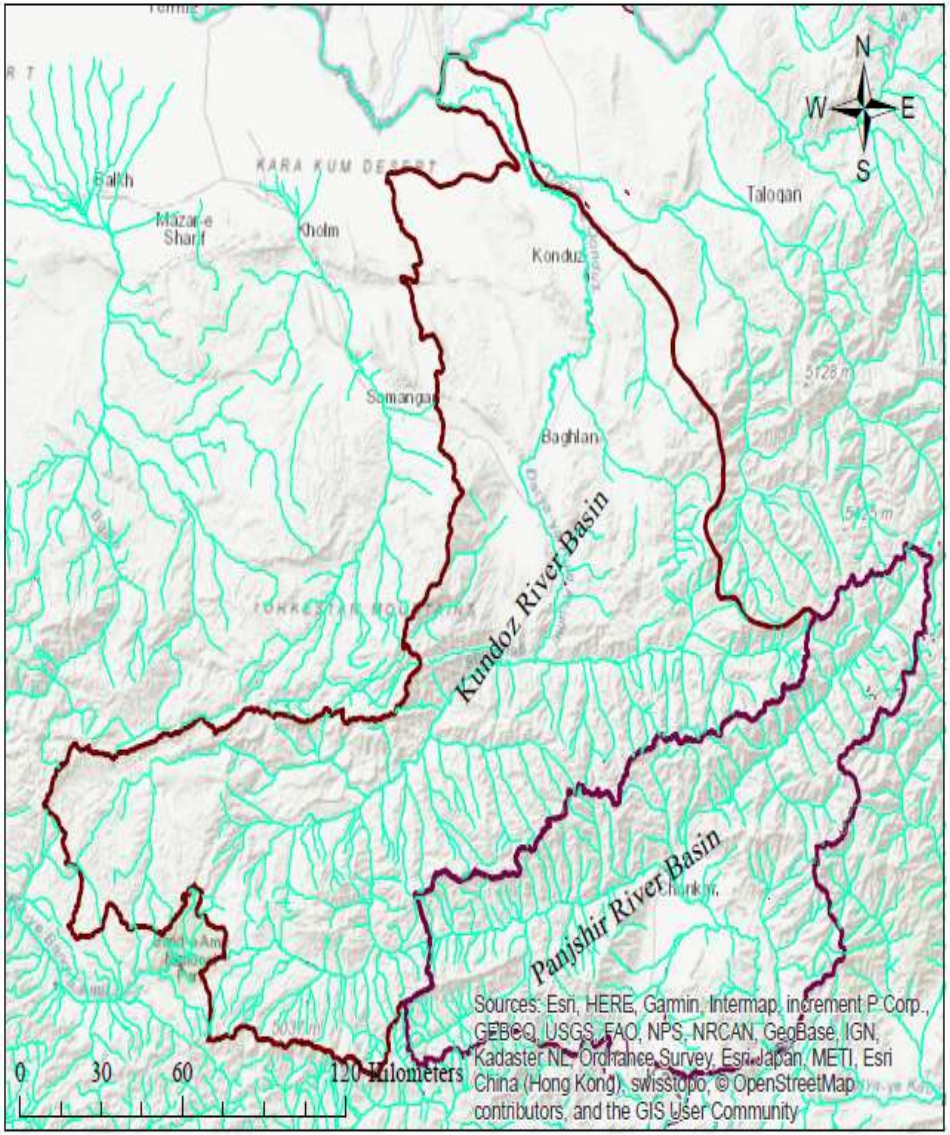
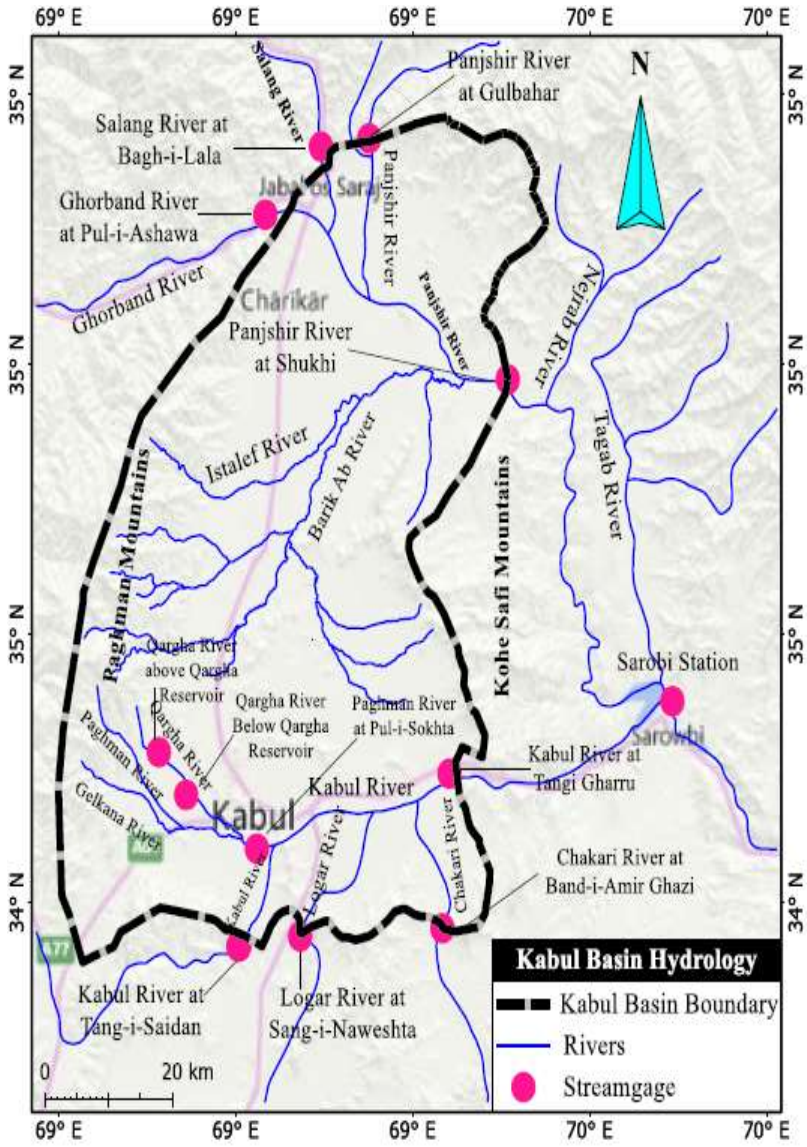
Hydrology





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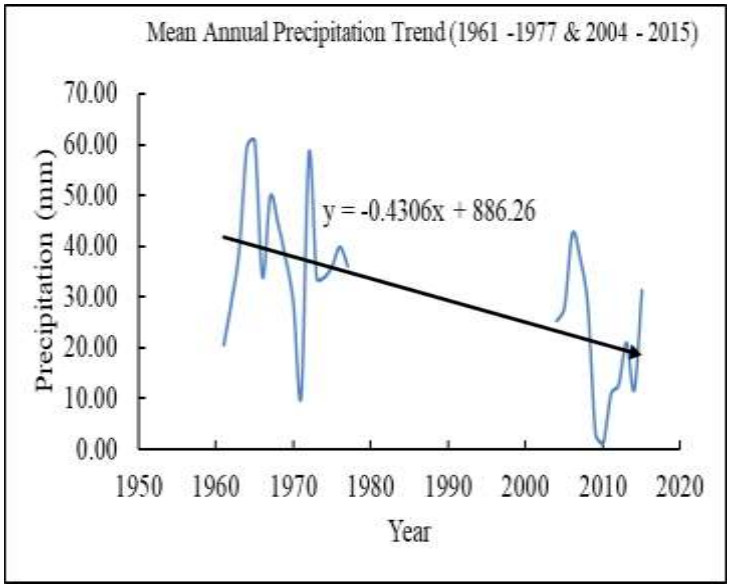
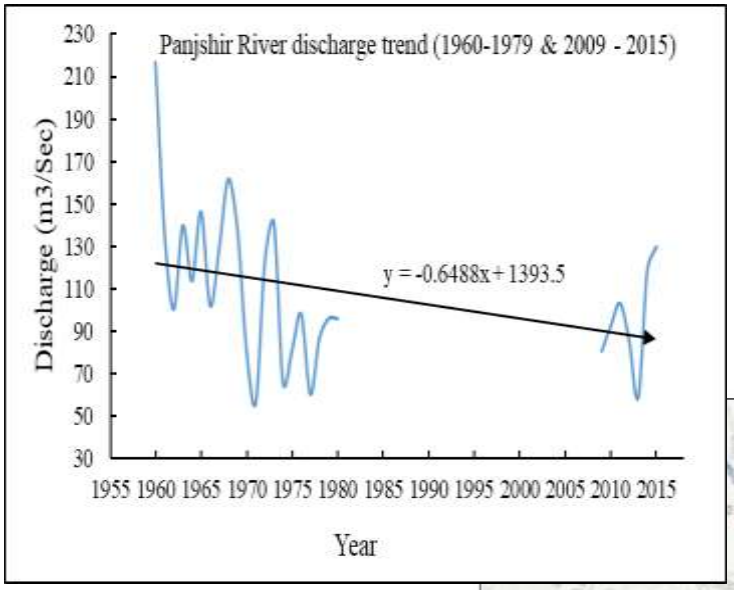
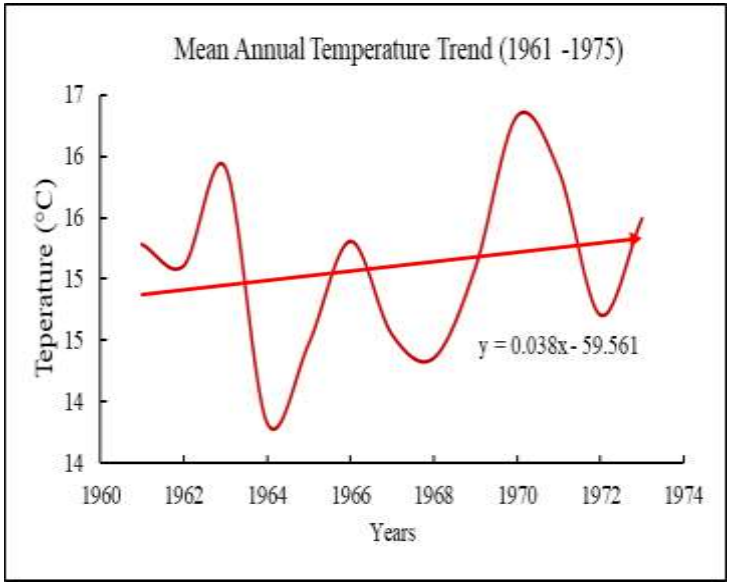
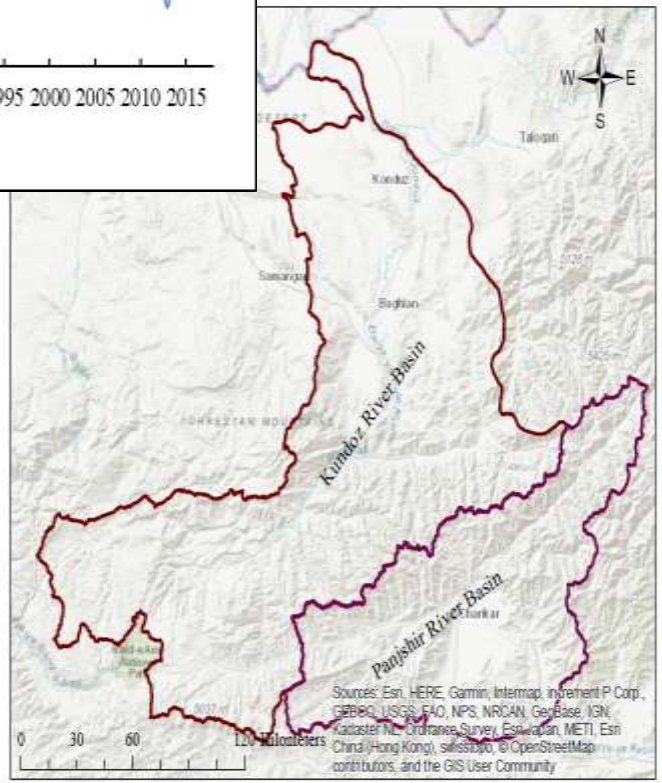
Climate Change Impacts









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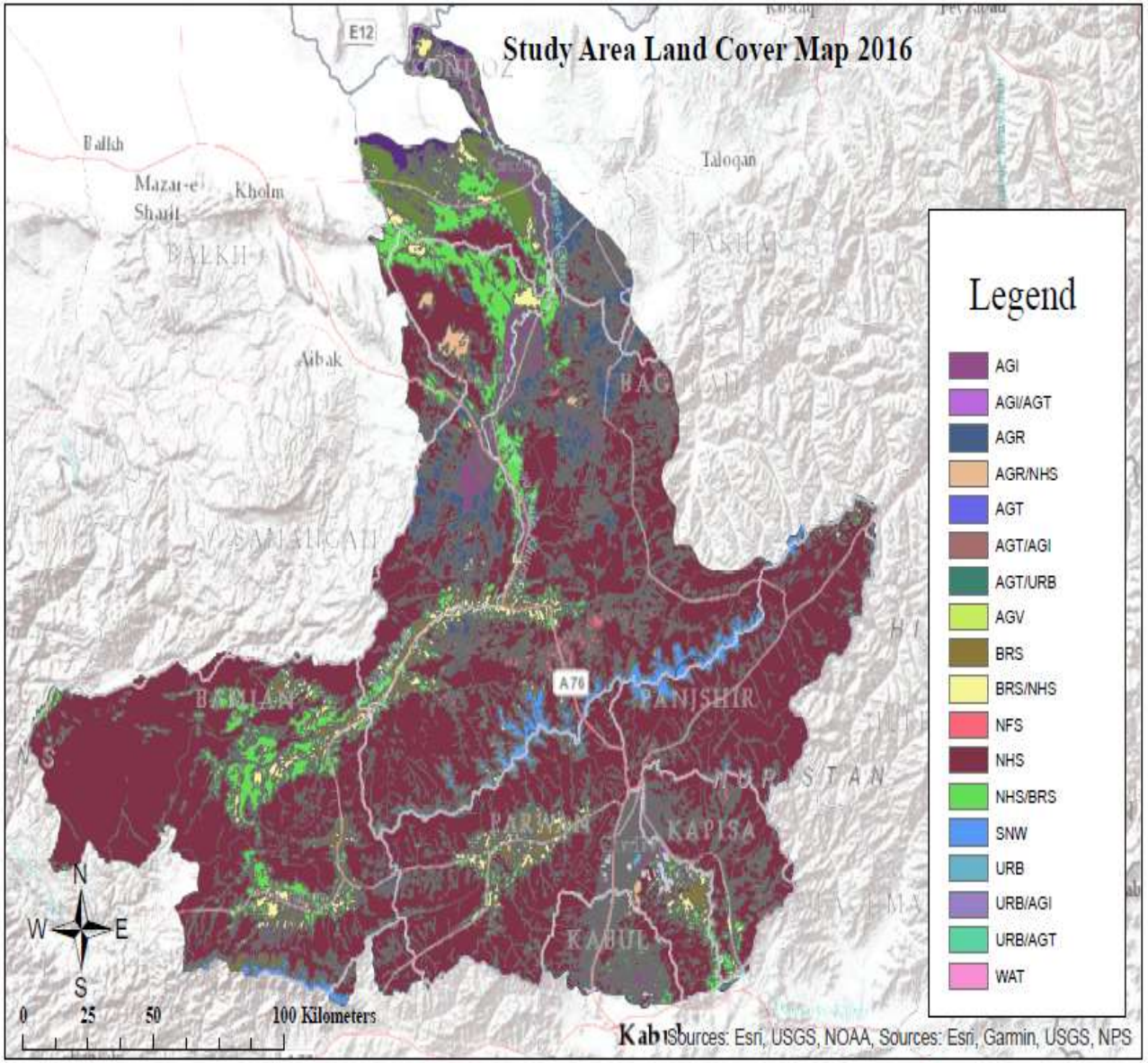
Land Cover



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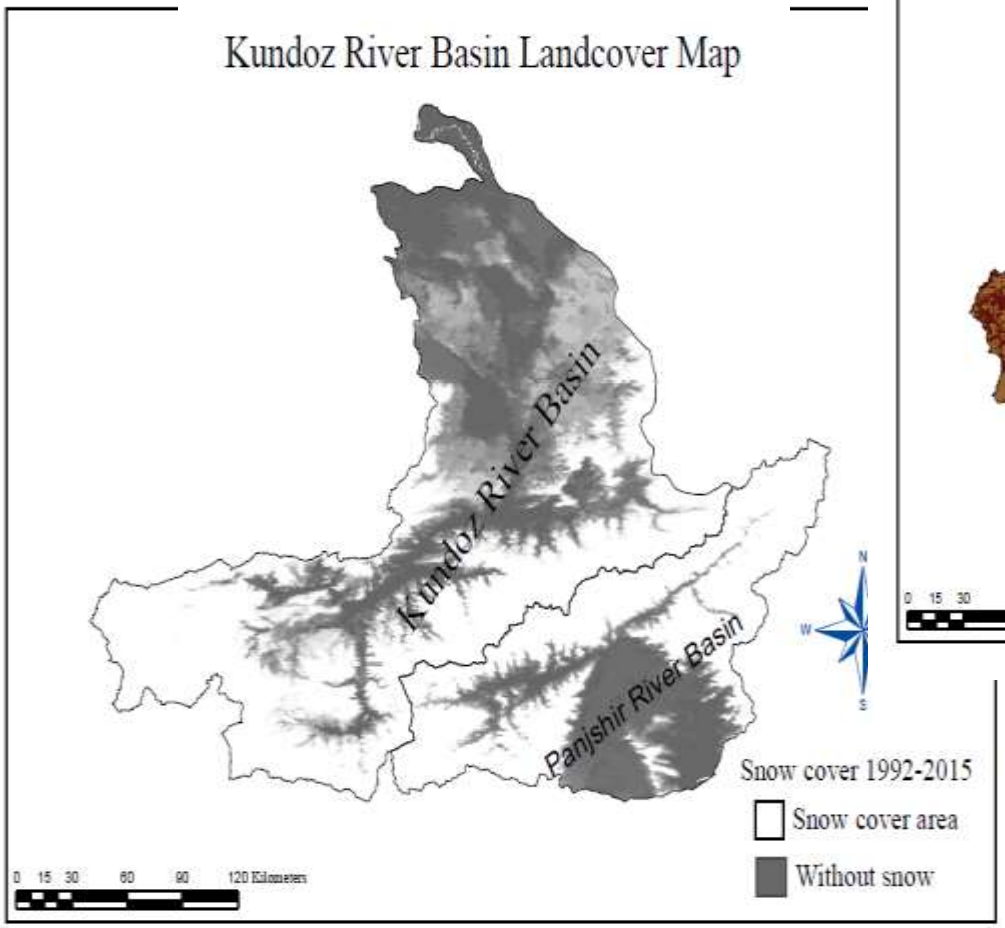
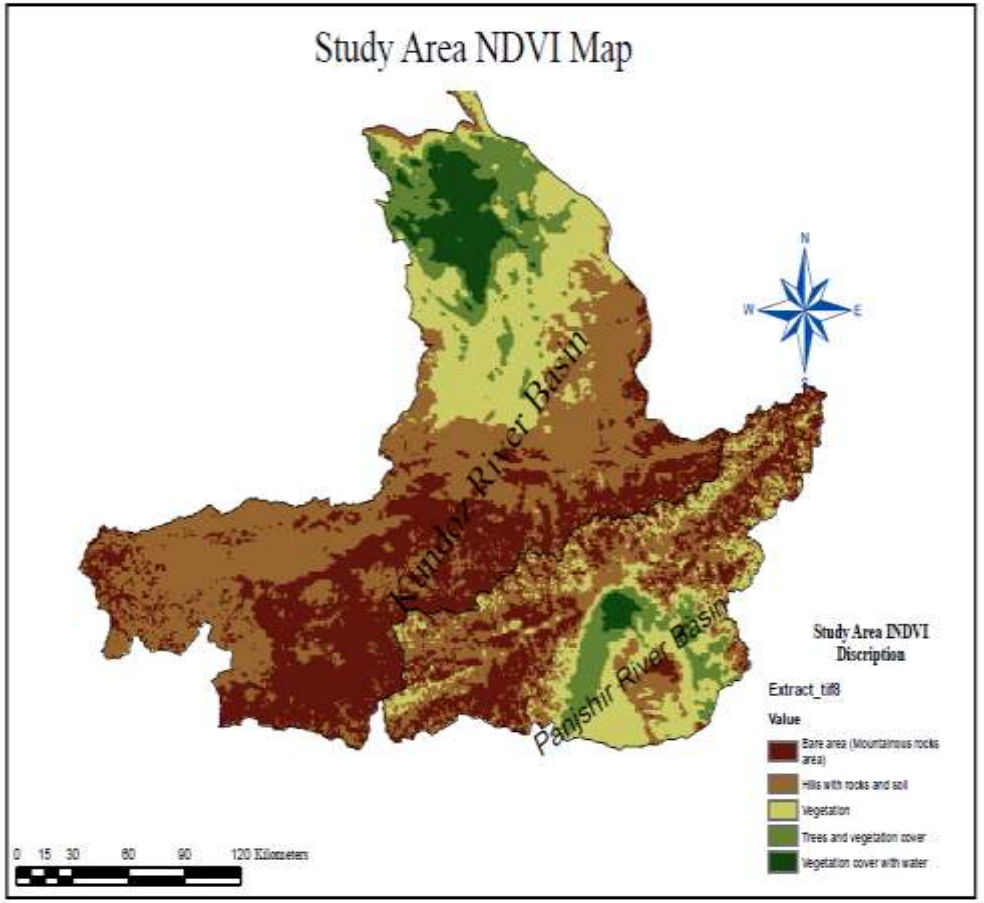
Snow Cover





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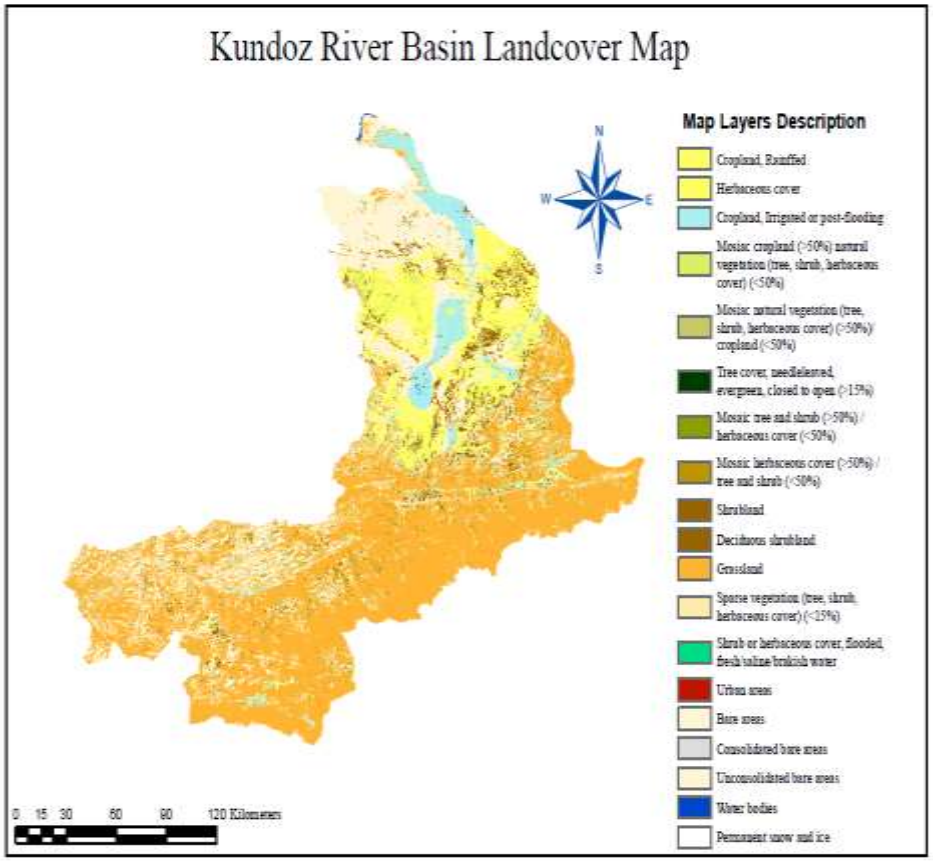
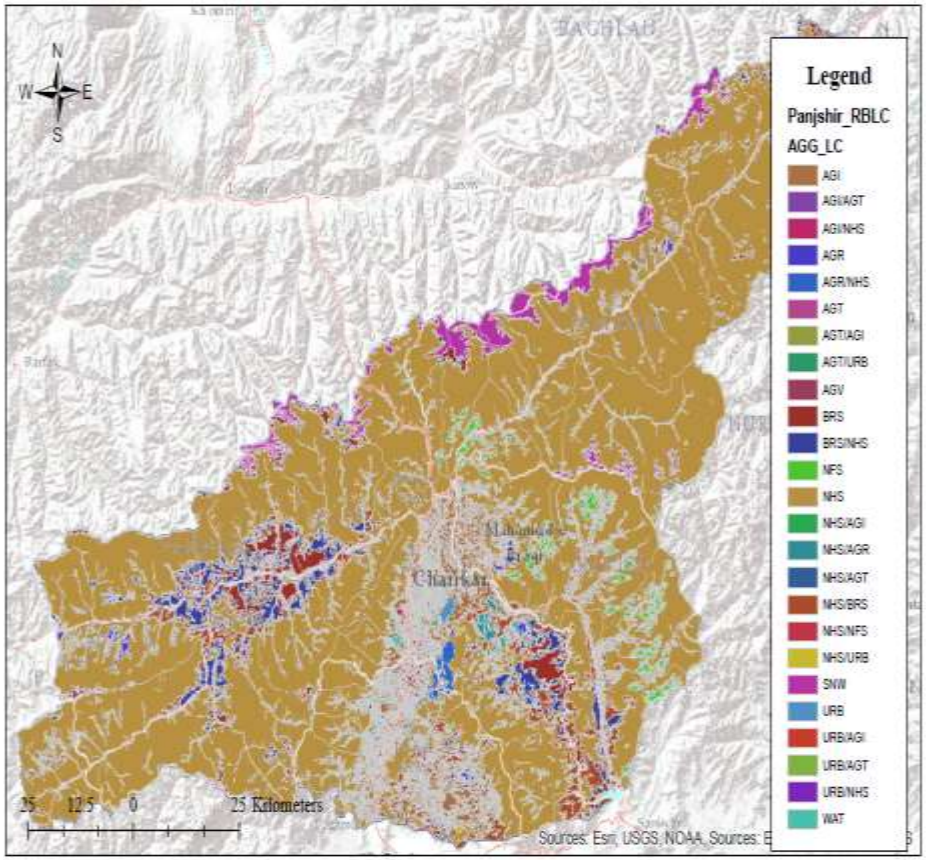
Panjshir River Basin
Land Cover





Conclusion and Recommendations

- **Land Cover: Limitation of data (Calculated and Recorded) but it is on the way.**
- General Project Implementation?
- Water resources protection; conservation and management.
- Rain water harvesting; Waste water treatment and reuse.

❖ ***Climate Change Mitigation and Adaptation:***

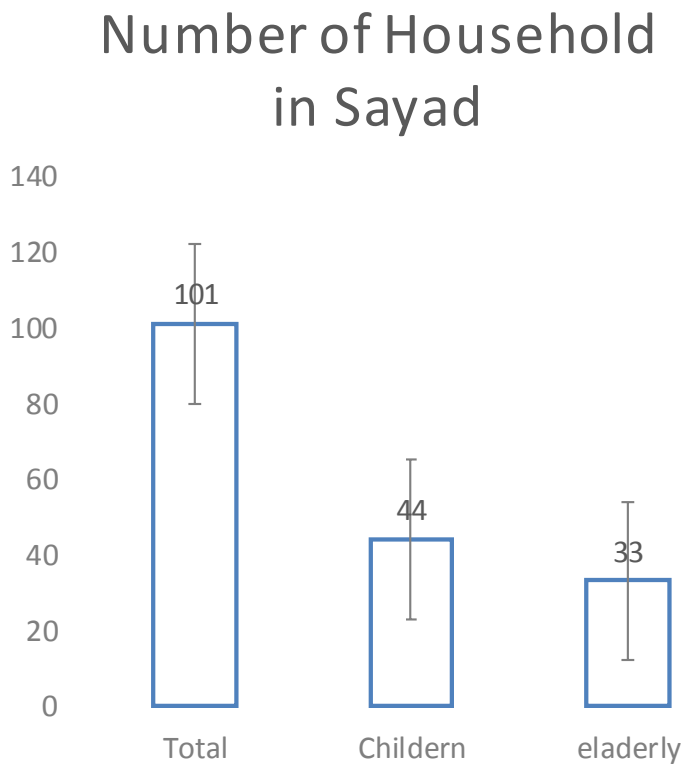
- Ecosystem based approaches: water resources management and sustainable energy use.
- Green Energy: Developing hydropower, solar, biomass, hydrothermal, wind energy resources no fossil fuel energy use.

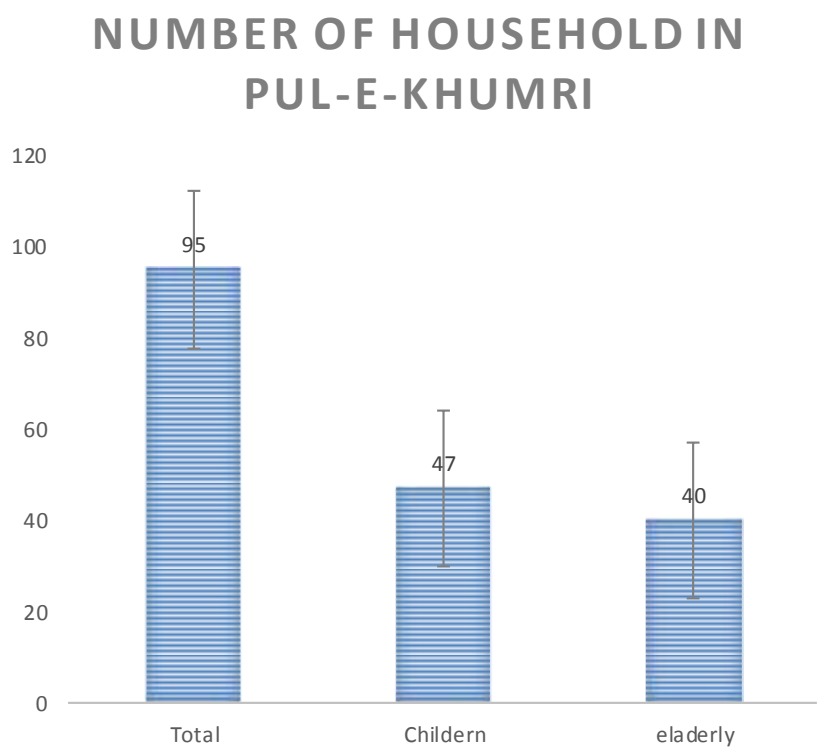
❖ ***Joint work of the Amu River Basin countries on***:

- Mitigation, adaptation and environmental management.
- Capacity assessment, collection and sharing existing data, analyzing and interpretation of the data.
- Transboundary water resources conservation and management.

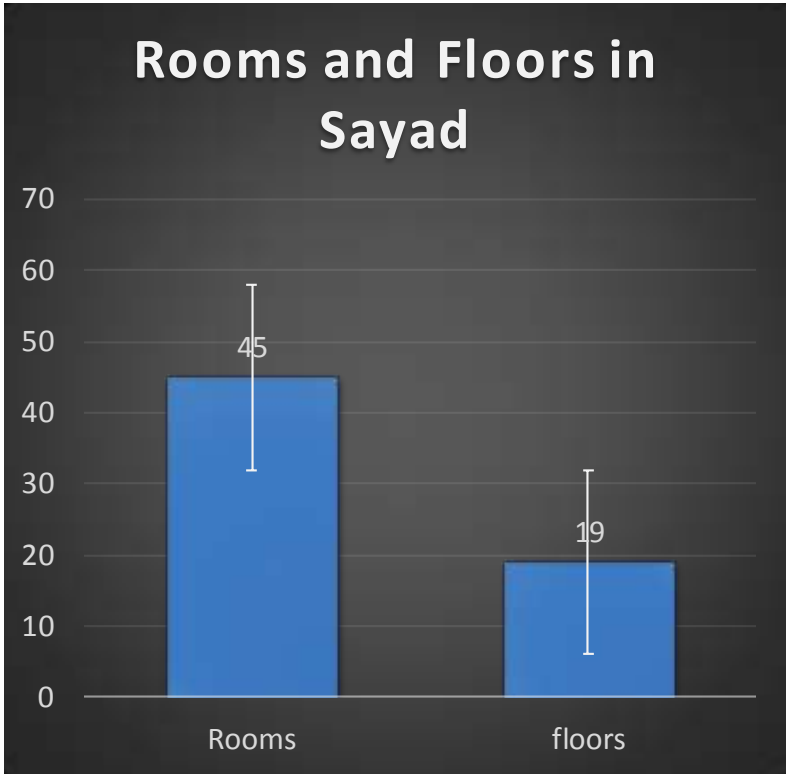
The Comparison of Panjshir and Pul-e-Khumri Based on Socio-Economic Questionnaire

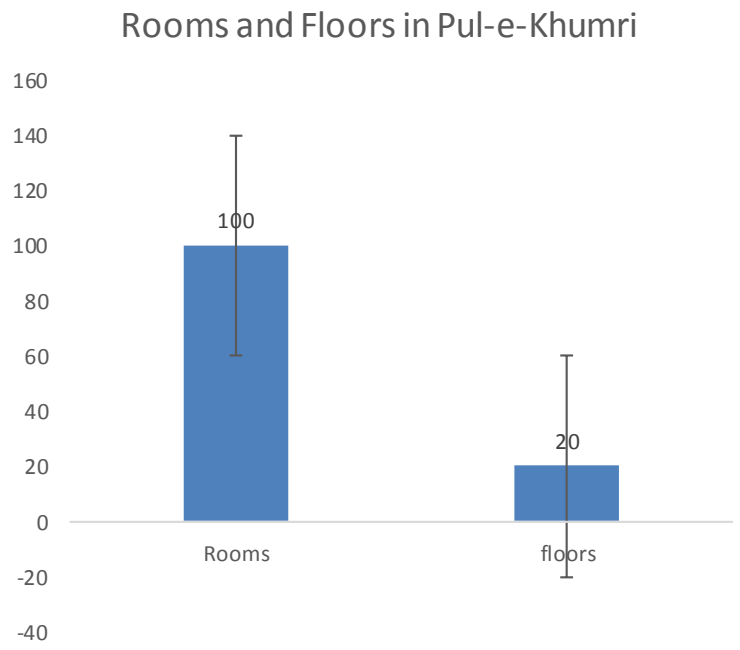
Household Numbers



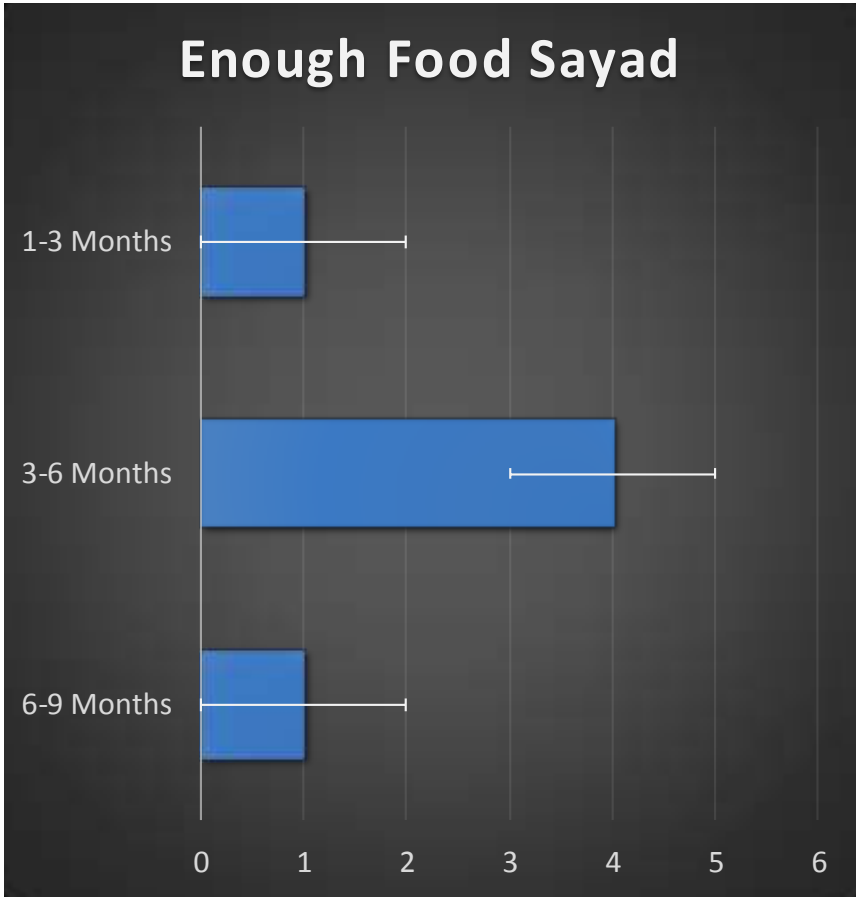


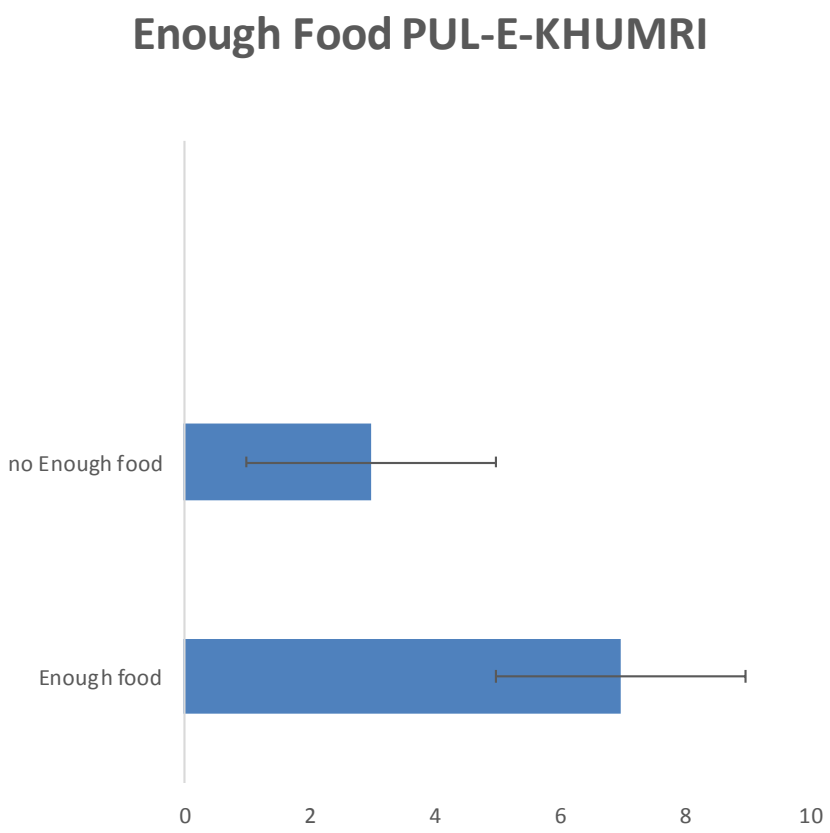
Room at floors



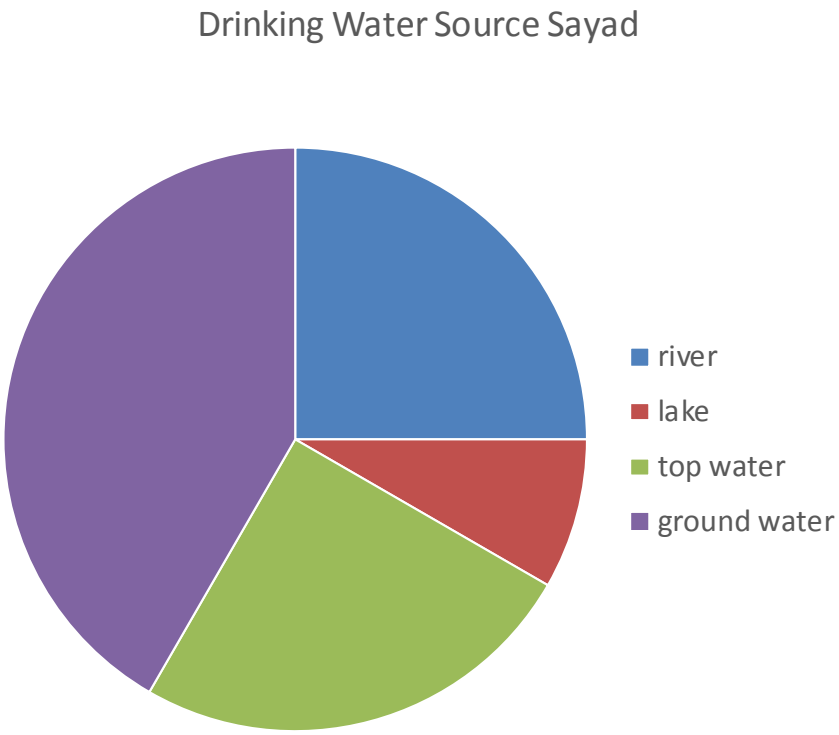


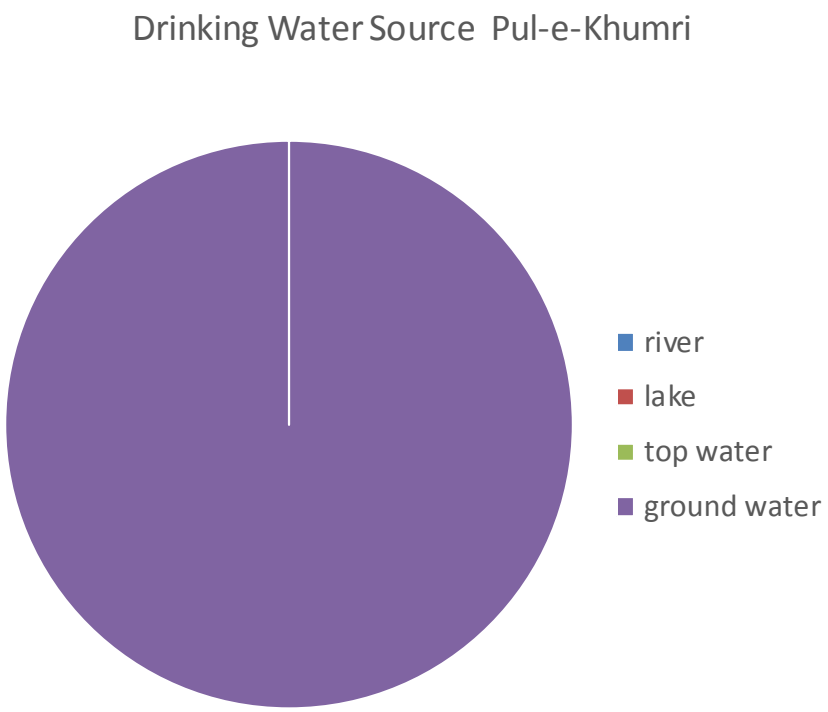
Food Condition



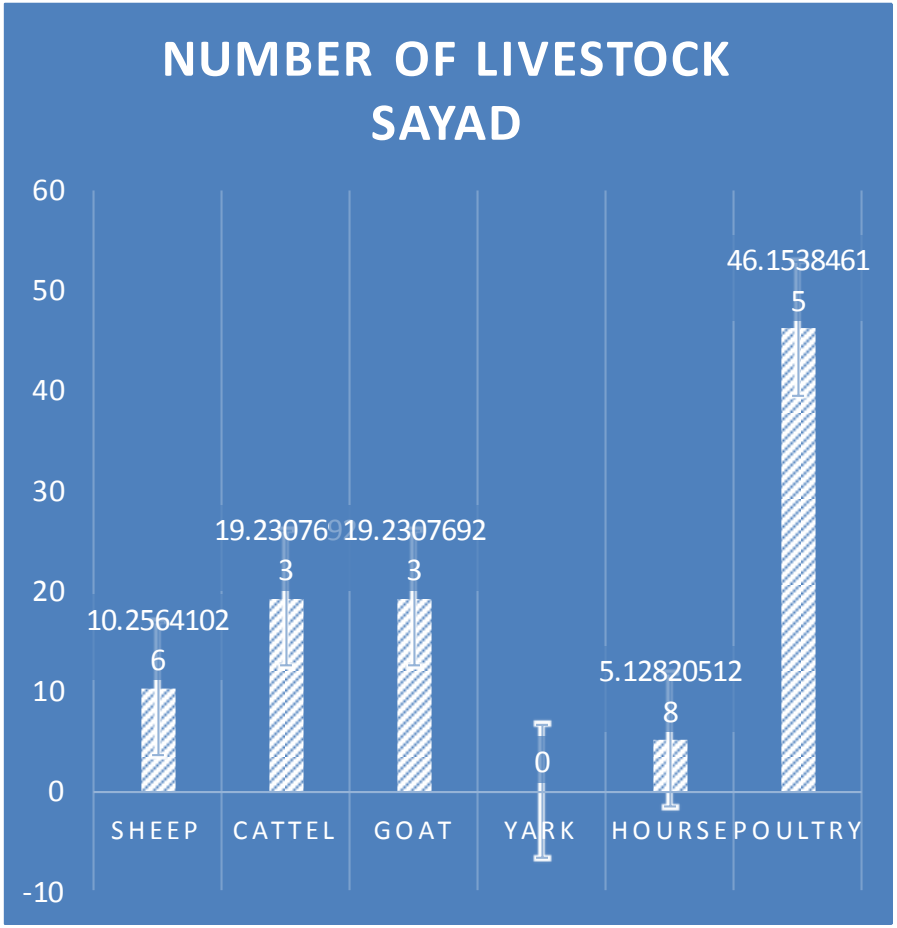


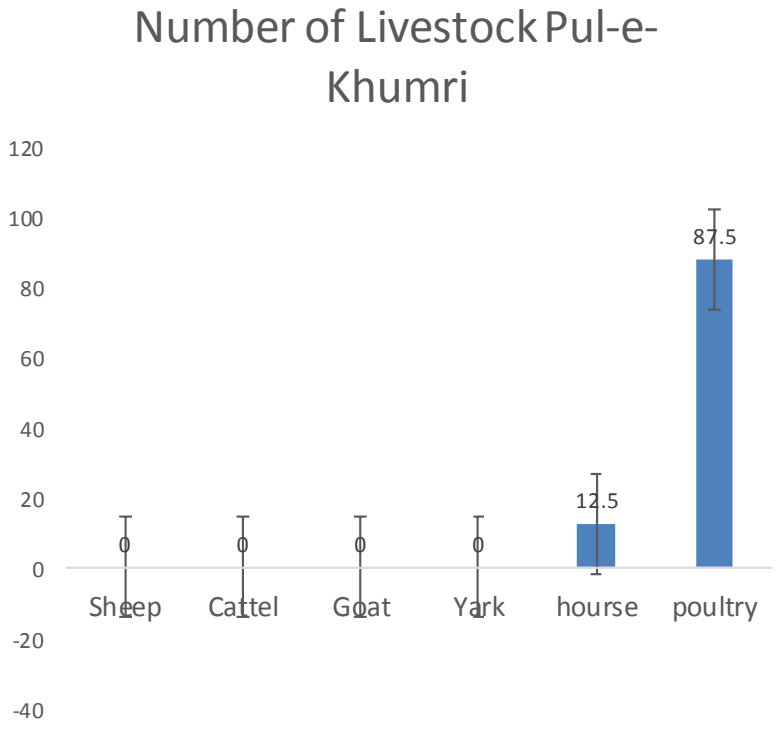
Drinking Water Sources



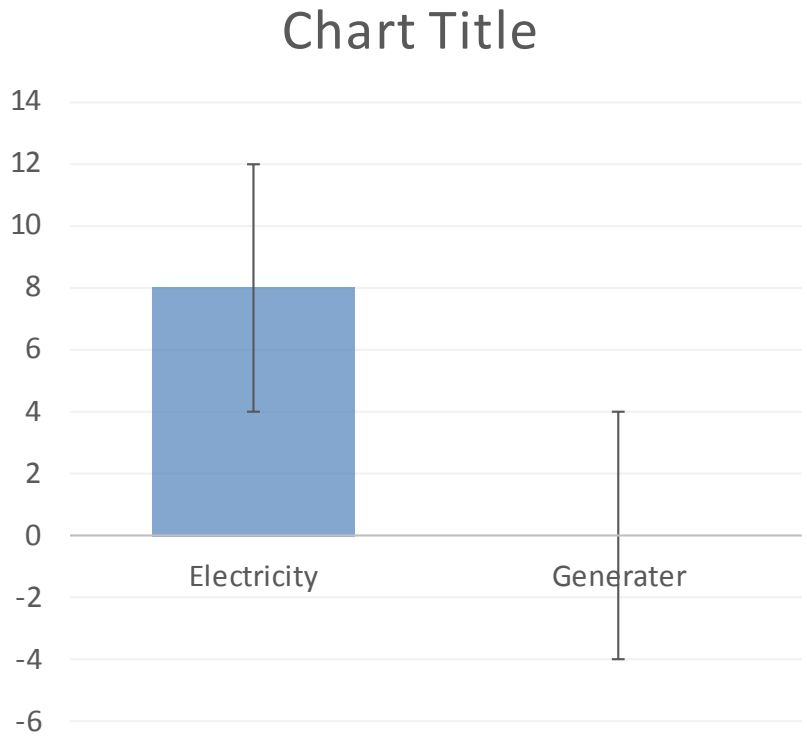


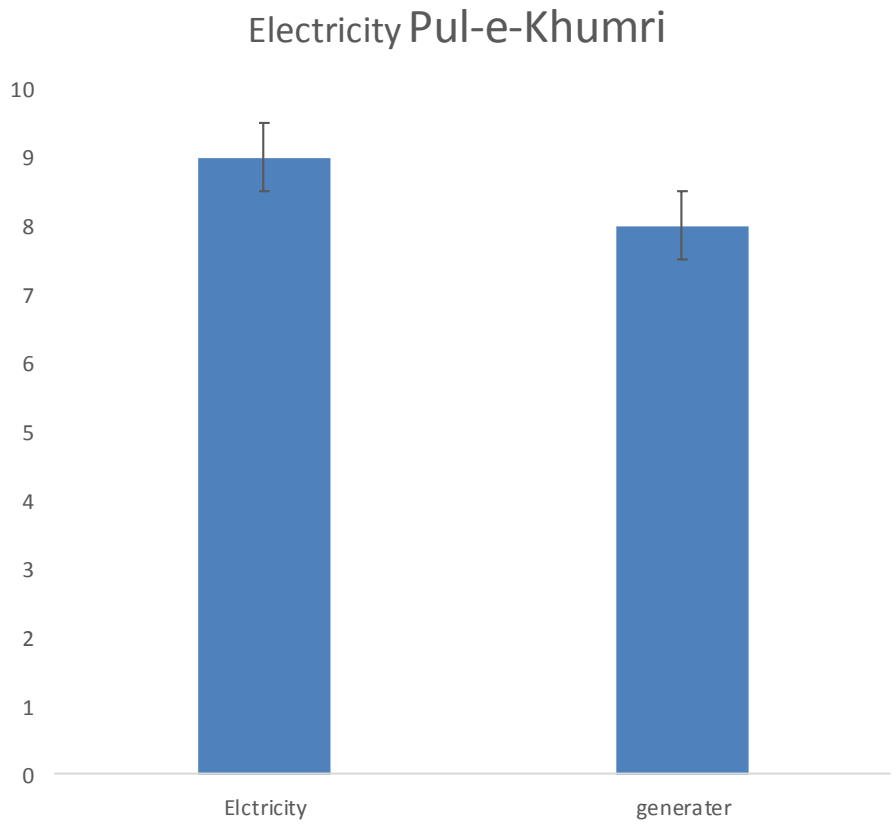
Number of Livestock



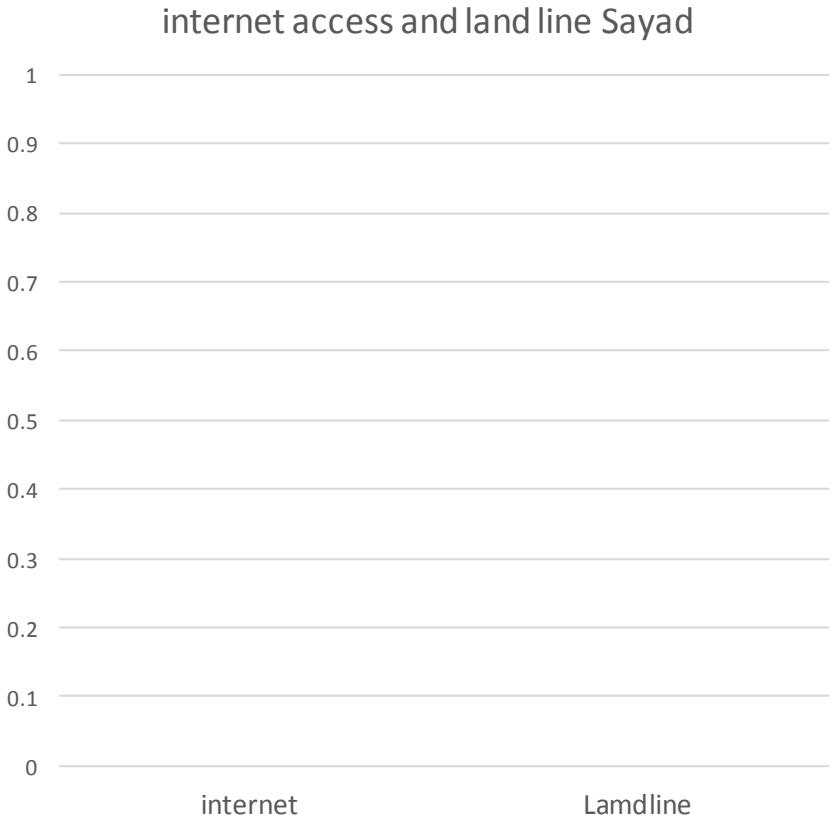


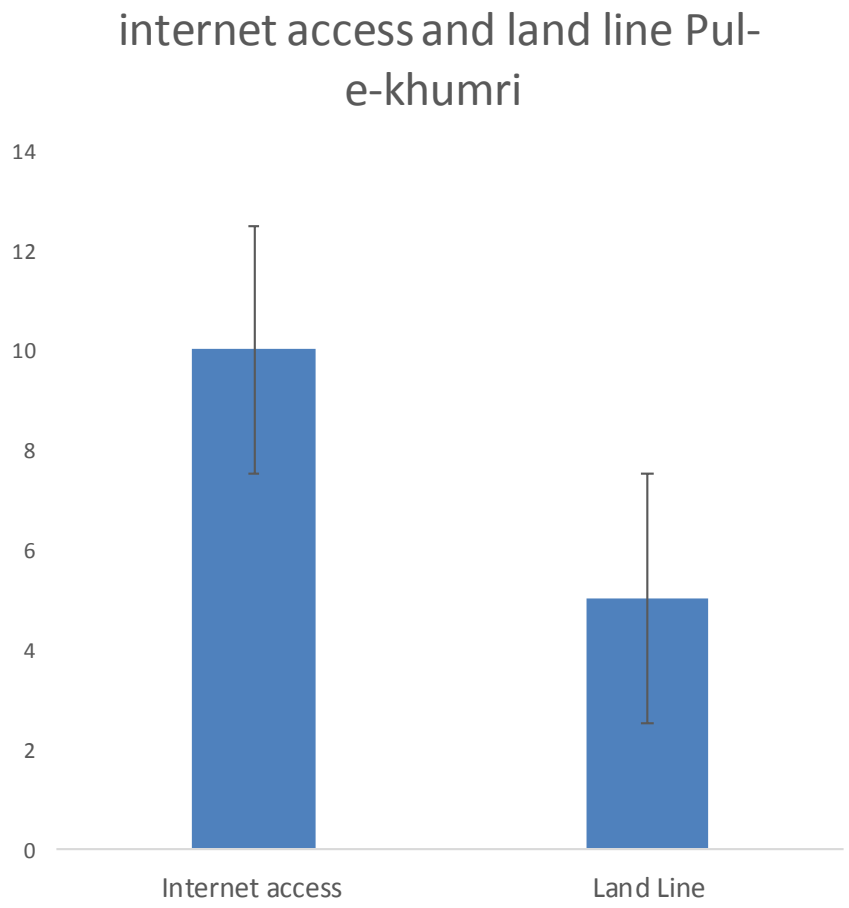
Electricity



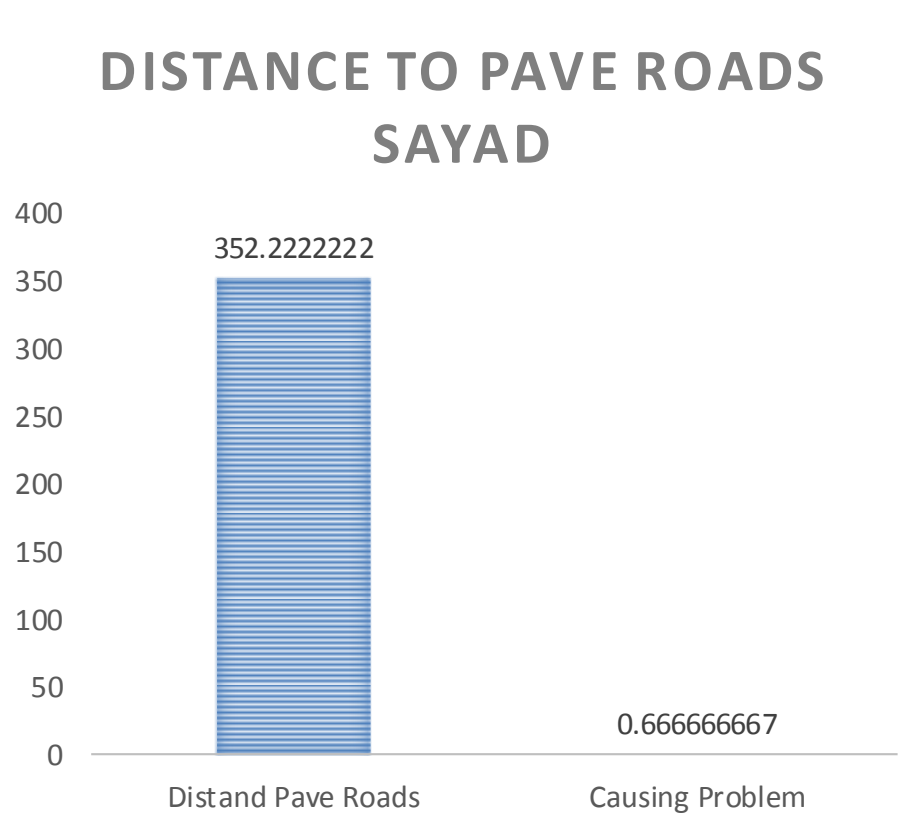


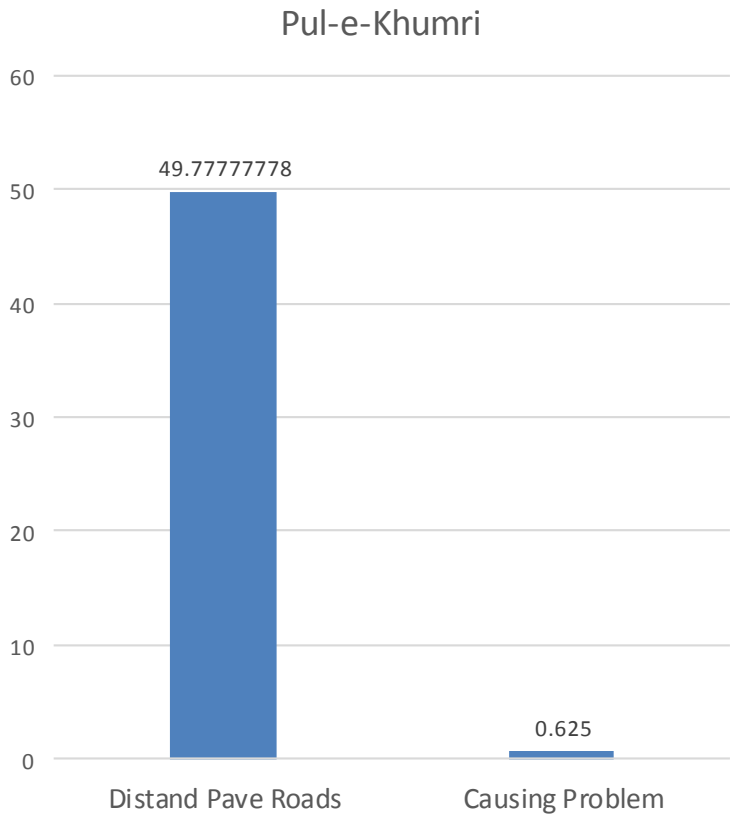
Internet Access



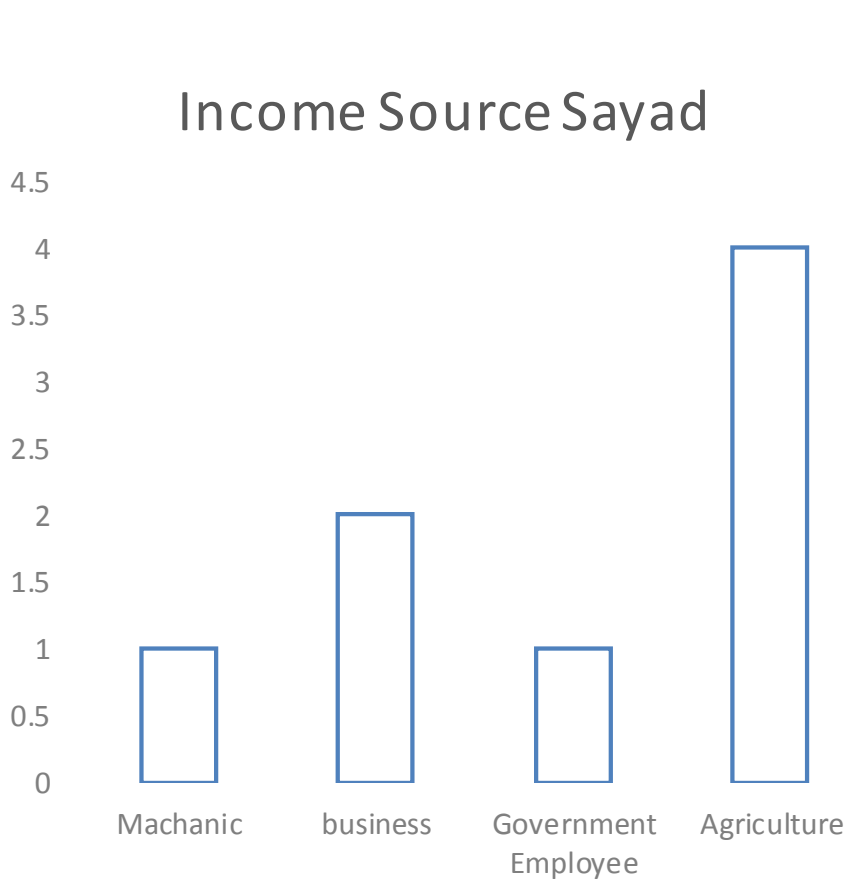


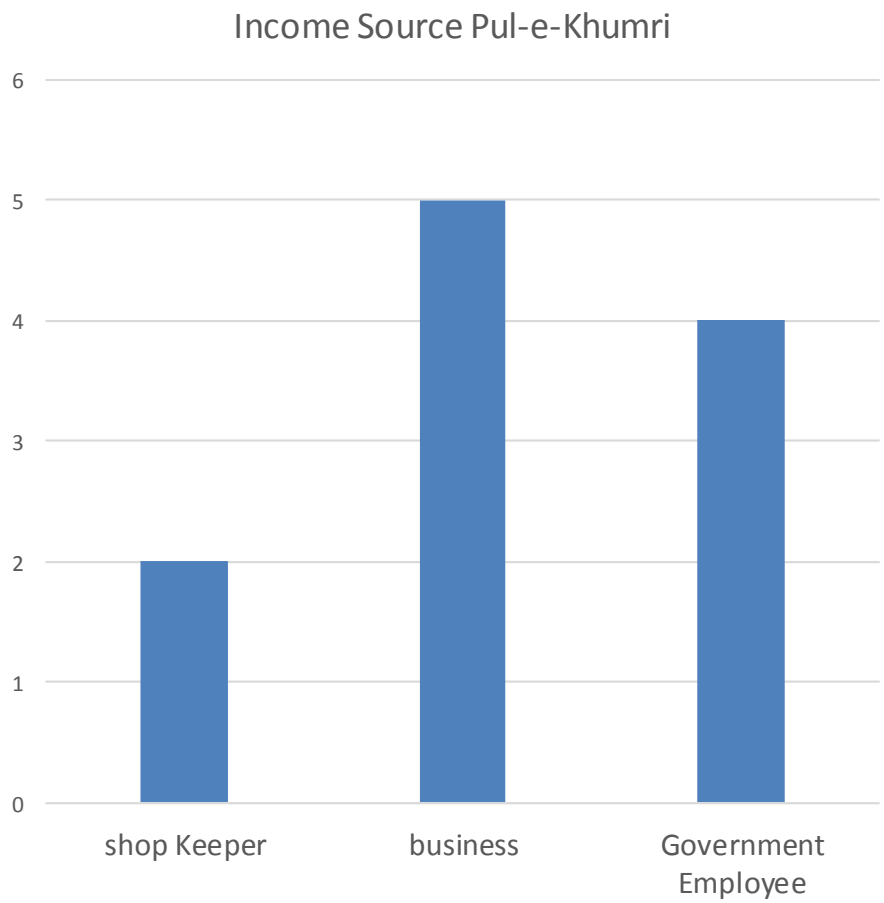
Distance from Paved Roads



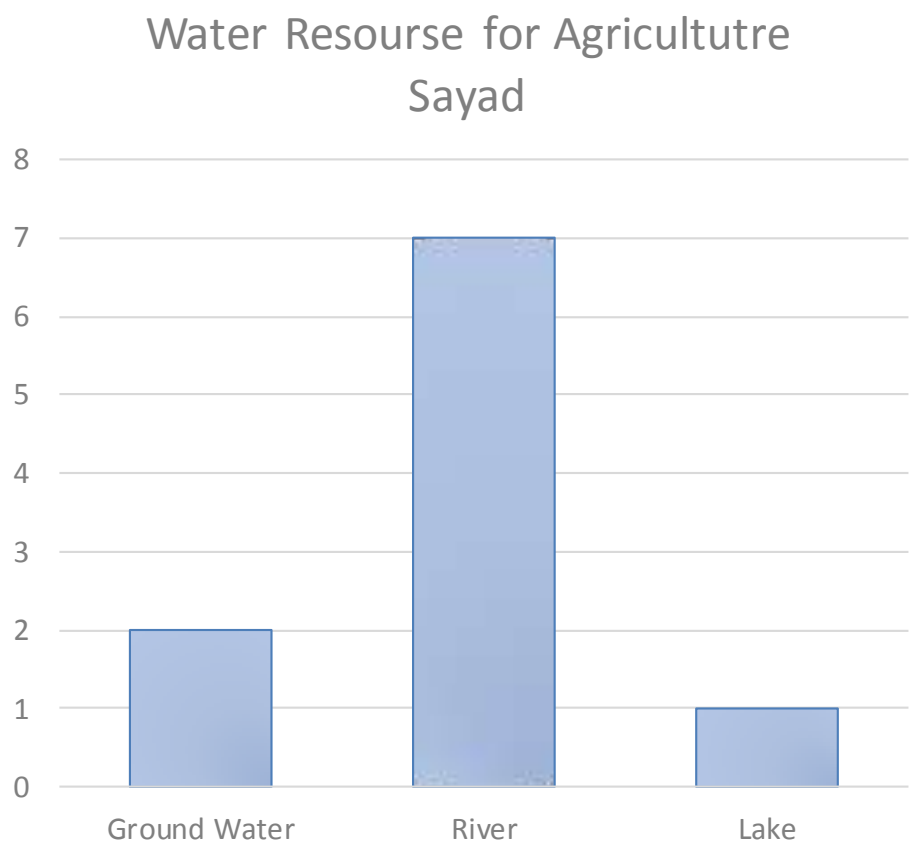


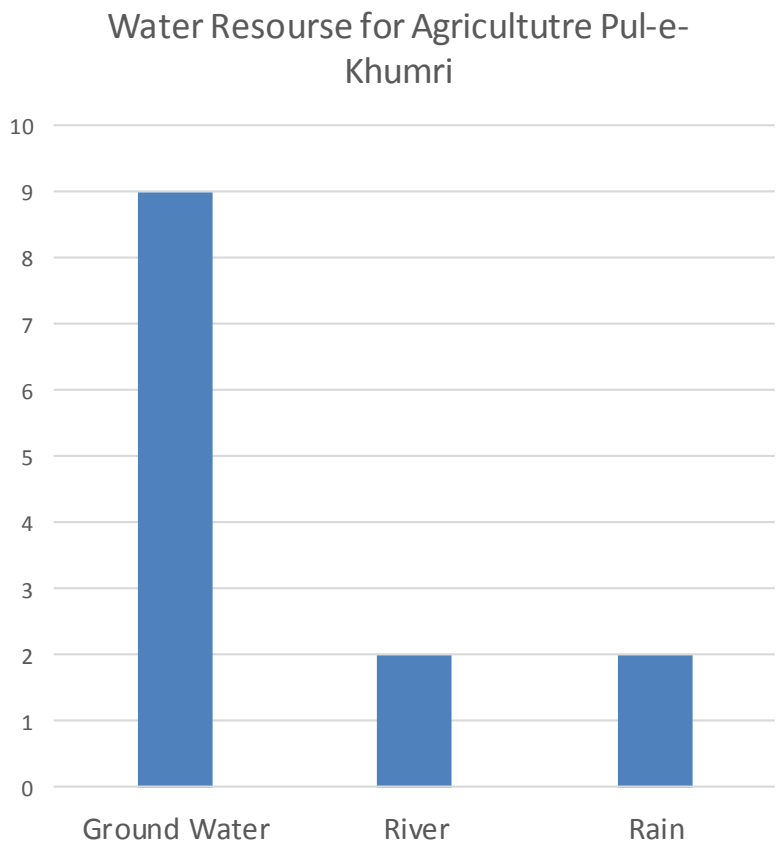
Income Sources



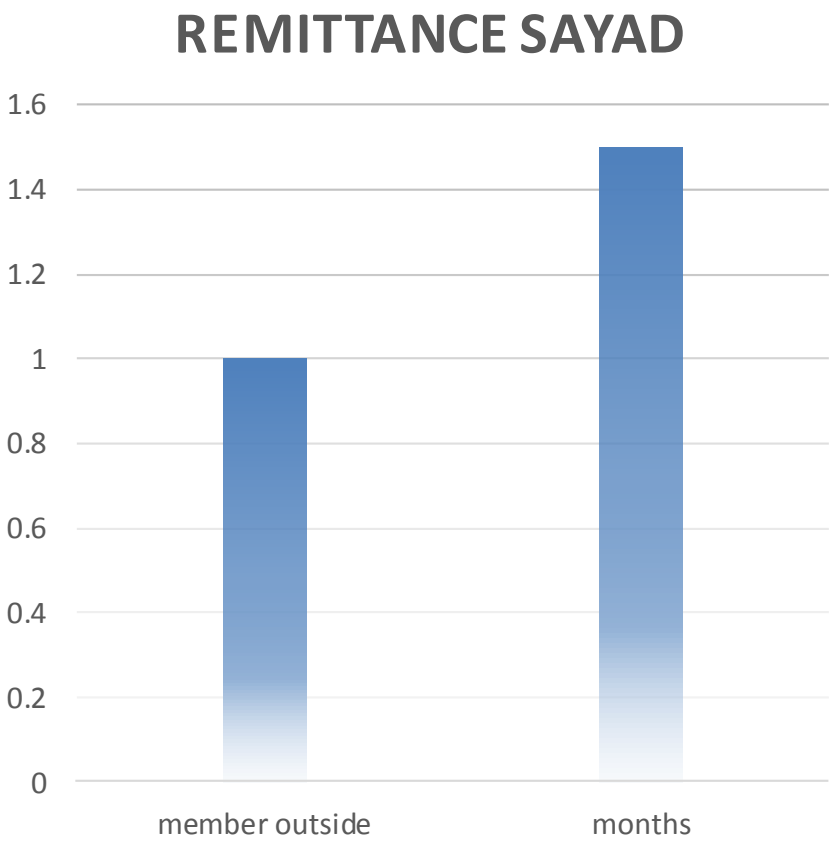


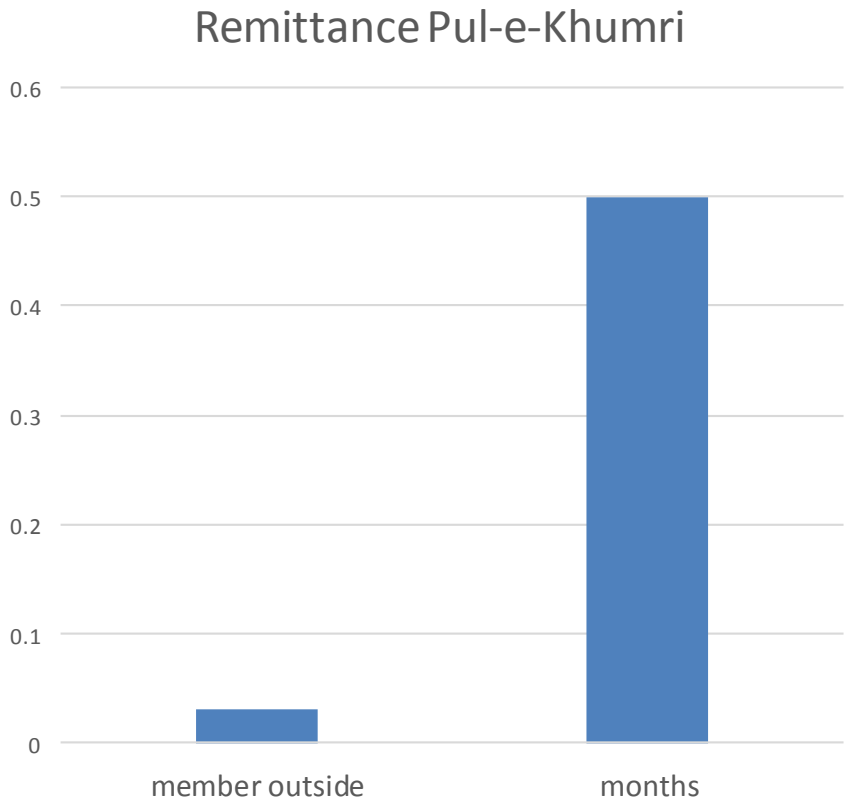
Water Resource for Agriculture





Remittance


REMITTANCE SAYAD
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
member outside
months


Remittance Pul-e-Khumri
0.6
0.5
0.4
0.3
0.2
0.1
0
member outside
months

Thanks for Attention